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The College Graduate in Business

WALTER S. GIFFORD, president of the American Telephone & Telegraph Company, gives, in the May issue of Harper's, figures bearing on the relation of the earning capacity of college graduates in the employ of that company to their records as students.

The comparison is based upon the earnings of the median man in each group (that is, for example, of the 50th man in a group of 99) rather than upon average earnings, which are sometimes greatly affected by one or two exceptionally high salaries.

Many individuals in each group did better than, and many not so well as, this man. There are poor students who are succeeding well and men who ranked high as students who are not so successful in business. But, on the whole, the evidence is striking that there is a direct relation between high marks in college and salaries afterward in the Bell System.

And the curve of increase in the earnings of the median man in the groups with the higher marks has a decided upward trend, while that of those in the lowest third has a downward tendency.

The longer the best students are in business, the more rapidly their earnings increase. The longer the poorer students are in business, the more slowly their earnings rise.

A great many of the higher positions in the system are held by men who did not go to college. It is proposed to make a similar study of the relation between the school records and the progress in business of the men who did not have a college education.

Business and industry are full of instances of men who have attained eminence without a collegiate training.

Something lighted up in them the interest, the spirit of devotion, the power of application and analysis and decision, the faculty of getting things done, that made them the chosen ones when leadership and direction were needed.

Does a college course, better than an early plunge into the actualities of the counting room or factory, tend to bring out and develop these characteristics?

It ought to, besides giving to the graduate the cultural advantages that make life so much fuller and success so much more fruitful.

But Mr. Gifford's study, while it should be a spur and an inspiration to the student in or out of school or college, is a demonstration of the fact that the qualities that made these young men excel in their earlier tasks persisted and were effective in their later careers, rather than of the much-discussed value of a college education as a preparation for a business life.

F. R. Low

Conflicting Views on Industrial Mergers

PROPOSED railroad consolidations and the great number of public utility and bank mergers serve to call attention to one of the strangest paradoxes of the day. Government still fears the combination of industrial units, mere size seeming, to the official eye, to be dangerous, and hence the trend is combated as best it may be. Industry recognizes the economies flowing out of rational combinations, and considers that the morals of a business have no relation to its bulk.

Here are two contradictory viewpoints. Which will prevail?

For better or worse, the United States is definitely an industrial nation. Without the continued healthy growth of industry, its people will suffer—some even perish. Industry must prevail. Government, still largely legalistic and agricultural, must veer to the industrial side. Engineers must look forward to a future of larger and fewer industrial units, and should be prepared to hold their places under such a régime.

Truth and Smoke

FEAR of facing the truth is a common failing of mankind, but one that is hard to excuse. Generally, there is no excuse for it, and in the case of the smoke nuisance, so far as that is caused by industrial plants and utilities, its disregard is nothing less than willful.

It has been said, too often, that the blame for the smoky condition of American cities rests largely on domestic heating furnaces. This is far from the truth, and one has only to look from the windows of the high buildings to see the black clouds that roll out of the power-house stacks.

Engineers know that smoke means waste. They also know that fuel can be burned efficiently—without pollution of the air. If the companies with which engineers are associated do not know this, it is time that the facts be brought home to them. When industry is honest about the smoke nuisance, half the battle of the abatement campaigners will be won.

That Coal Pile

COAL contains heat. Heat is energy. And energy is whatever man has sense enough and skill enough to do with it. The engineer's job is not finished when, by the exercise of skill and knowledge, he has turned the energy of coal into the fluid and usable forms of electricity, steam, refrigeration, compressed air and so on, and put them each in its proper conductor. He must see the job through—in short, deliver the gods.

Burning coal is one of the engineer's jobs and a very important one. It is another important job of the engineer to make effective use of the steam produced to generate power in prime movers. But the day has long passed when the "power house," the localized generating establishment, can limit either the interest or the activity of the engineer. The goods must be delivered to the customer—the production man.

Electricity must be carried to the motor on the productive machine. Mechanical power must be guided along shafts, pulleys, belts and gears to its objective. Steam is wanted, not *out of* the power house, but *into* the process. Heating and ventilation are measured by the comfort of the human receivers; the shivering workman doesn't give a whoop about the reading of the boiler steam gage, or the r.p.m. of the indirect heating fan. The ice man is looking for cheap ice, and good; if he doesn't get it, no library of perfect indicator cards from ammonia compressors will make him happy.

And so, again, the engineer's job is to deliver the services with the maximum effectiveness and the minimum cost, when and where they are needed. Anything short of that is a nine-foot plank bridging a ten-foot chasm.

Effects of Competition

REFERENCE has already been made in these columns to the decision of the Detroit Edison Company to install stokers in their new power plant at Delray. This may be regarded in later days as a milestone in the development of fuel-burning equipment.

The high sustained efficiencies secured on the first large powdered-coal plant at Lakeside Station, Milwaukee, led to the installation of many powdered-coal plants, as these efficiencies appeared to justify this type of plant in preference to stokers. Water-cooled furnace walls and the use of preheated air were further developments resulting from the introduction of powdered coal.

The stoker manufacturers at once prepared to meet this new competition. They increased their stoker sizes to get the extra capacity needed, added water cooling to the furnace side walls to permit higher rates of combustion in the furnace, and found that preheated air improved combustion, resulting in less carbon loss to the ashpit. The water-cooled walls also permitted the absorption of much radiant heat from the fuel bed. The result of these improvements has been the development of stokers that can compete successfully, both on a cost and on an efficiency basis, with powdered coal.

It now remains to be seen what the powdered-coal equipment manufacturers will do to place themselves again in the lead. Obviously, their plant must be simplified and made more compact and must cost less. One is inclined to speculate on whether this development will come through the improvement and adoption of unit mills, or whether the central system will be modified to reduce drying, pulverizing and transport costs and furnace volumes materially below present-day practice. These developments to meet increasing stoker competition will undoubtedly lead to improvements that will result in the production of cheaper steam.

What Good Is Efficiency Without Judgment?

EFFICIENCY is one of those things that you may not have when you think you have it. There is little use of buying efficient equipment unless all the auxiliary apparatus is designed accordingly. The difference in efficiency of given types of pumps and motors, built by the various manufacturers, is comparatively small. When the prospective purchaser asks for quotations on pumps and motors, he often bases his final selection on a difference of a fraction of one per cent in efficiency.

Unit efficiency should be considered, of course, but when a pump is selected because it has one-half of one per cent higher efficiency than some other make and is then installed under conditions where ten or twenty times this amount is lost, something is wrong with the engineer's thinking.

A long, undersize pipe line with a large number of

bends can easily cause ten per cent or more increase in head. This increases the pump load in proportion and may also affect the characteristics of the pump in such a way as to reduce its efficiency.

On the electrical end of the equipment, if the power feeders are long and undersized the losses may easily reach ten per cent. Even when the conductors are pulled into conduit, a large part of this loss can frequently be avoided with no other expense than the cost of an increase in copper size.

Faulty installation is not the only place where efficiency is destroyed. Neglect in operation may easily account for a five or ten per cent loss, due to dirty strainers, leaky valves, worn thrust bearings, partly closed valves and the like.

High-efficiency equipment may well be worth the cost when properly installed and operated. Where first cost must be kept down, a little less spent on the equipment and a little more on the installation reflects more credit on the engineer than a finer machine crudely installed.

How Important Is Industrial Power House Efficiency?

EFFICIENCIES of industrial power houses have recently approached, in a number of cases, the best central-station practice. The newer installations, and even some of the older that have been modernized, leave little to be desired in the light of present-day practice. This is particularly true in cases where the process steam load allows a utilization of heat approaching one hundred per cent.

This advance is one upon which engineers deserve commendation. But not to the point of losing sight of the relative unimportance of this efficiency. What is meant can be no better expressed than in the words of the engineer of a great paper manufacturing company, who says: "Added efficiency in the paper-mill power house matters little until the amount of power waste in the industry is reduced. This now sometimes amounts to as much as fifty per cent of the energy output of the boilers."

Those familiar with industry will readily acknowledge the truth of this statement. But, although it is well known, not enough is done about it. The most important duty facing engineers today is to cut down this waste, which forms such a large part of the cost of manufactured goods. To do this, the engineer must come out of his power house and study thoroughly the manufacturing processes in his industry, and how power enters into them. Improvement in the application of power to production is a paramount duty of the power engineer.

Steam Pressures in the Limelight

JUDGING from the prolific discussion that followed the two power papers at the recent A.S.M.E. Spring Meeting, opinion with regard to high steam pressures is still far from crystallized. Between the conservative group of engineers, who are content to advance by small increments of pressure, and those who have had the temerity to bridge the gap in one jump, there is small chance of agreement. However, certain facts appear to have been established by experience with high-pressure plants to date:

A twelve hundred-pound installation need cost but little more (five to ten per cent) than a four-hundred-pound plant. Over-all plant efficiency is improved, other conditions being equal. Such troubles as have been encountered have been due to factors other than steam pressure. There are some who believe that the most promising field for high steam pressure is when superimposed on an existing low-pressure plant. While this presents many possibilities and the pioneer installations were of this order, several complete twelve-hundred-pound plants are now under construction.

In the industrial power-plant field high pressures offer a means either of increasing existing capacity or, with a given capacity, of reducing the available exhaust steam in order to meet more closely the demands of improved processes.

Those who prefer a moderate pressure because of less cost, simplicity and ease of operation, point to the fact that present low coal costs are not so favorable to the employment of high pressures. This is quite true, but one can hardly expect present conditions in the coal industry to last indefinitely. On the other hand, low capacity factors do not justify the present additional cost of high-pressure plants, and progress is so swift that few plants long operate on the load conditions for which they were designed.

In the present discussions on high steam pressure one is reminded of the spirited arguments that enlivened engineering meetings a few years ago between the proponents and opponents of pulverized coal. Experience with pulverized coal has proved that it has an important field, but is no panacea for combustion troubles. Similarly, high steam pressures have a place, but, undoubtedly, before this is generally recognized some unjustifiable installations will have been made, just as was done with pulverized coal. Because a thing happens to be very much in the limelight is no justification for its employment under all conditions.

An Exceptional Report

APPROXIMATELY thirty per cent of the bituminous coal mined in the United States is consumed by the railroads. Of this one-tenth, or three per cent of the total, is burned in stationary railway power plants. This represents nearly one-half that used by all the central stations—a fact so amazing as to be almost unbelievable.

The number of these railway plants is large and their average efficiency low, which explains the enormous coal consumption. A few are of fairly good size and modern, but the majority are relatively small (from two to three boilers) and lack both modern equipment and meters for ascertaining and building up the performance.

Happily, the Committee on Stationary Power Plants of the International Railway Fuel Association is actively delving into this previously neglected problem and appears to be receiving some support from the railroad managements. Subcommittees on oil and on coal firing have been busy during the year and have brought out respectively, reports on the adaptability of Diesel engines to such plants and on the use of pulverized coal. The latter is a most comprehensive treatise covering types of equipment, frank discussion of limitations as well as merits and certain operating data concerning unit mills. Although compiled with railway power plants in view, the information is applicable to any industrial plant.

The first two sections of this report are printed in this issue and will be followed in subsequent issues by the last two sections. They will bear careful study.

POWER SERVICES *Used in*

By S. E. Balcome

Chief Steam Engineer, Graton & Knight Company, Worcester, Mass.

MANUFACTURING leather belts starts with the preparation and tanning of the hides. The leather is then dried and prepared for use, after which it is made into belts and other articles, depending on the part of the hide from which it comes and the tanning process used. Steam, electricity and other power services are used throughout this work, making possible the efficient and economical operation of the belting plant.

Briefly, the steps carried out at the Graton & Knight Company plant, in Worcester, Mass., with which this article deals, are as follows:

No matter how economically power services are generated, it is the economy of application that counts in a plant's production costs. How a leading belt manufacturer takes care of this important point is outlined briefly in this article.

The hides, which have been first preserved by curing in salt for about 30 days, are received at the plant in bundles 18 in. square. Upon receipt, the bundles are opened, those for immediate use being sent directly to the process, while the remainder are laid down in salt for storage until needed.

The first step in the process is to put the hide in a washing machine, where it is tumbled in water, by means of a rotating paddle, and all salt and dirt washed off. This cleaning process occupies about one day.

The clean hides are then placed in vats containing milk of lime. At intervals, they are moved into others of a series of vats containing similar solutions, but of different strengths and ages. This "liming" process requires about one week. At its conclusion, the hair on the hide has become loosened and the hide is prepared to absorb the tanning material.

The hide is then put into a series of machines that remove the hair, and any adhering flesh or fat. After this it is washed to remove any dirt or lime that it may contain.

The next process to which the hide is subjected is tanning. This process varies as to materials and methods used, depending on the exact qualities desired in the finished leather. In general, it consists in soaking the hide in a series of tanning solutions, each stronger than the preceding one. The whole tanning process covers a number of weeks, its length depending upon the character of the untanned hide and of the finished leather desired.

After tanning is completed, the leather is soaked in warm water to remove excess tanning material. It is then oiled, after which it slowly dries under controlled conditions of temperature and humidity.

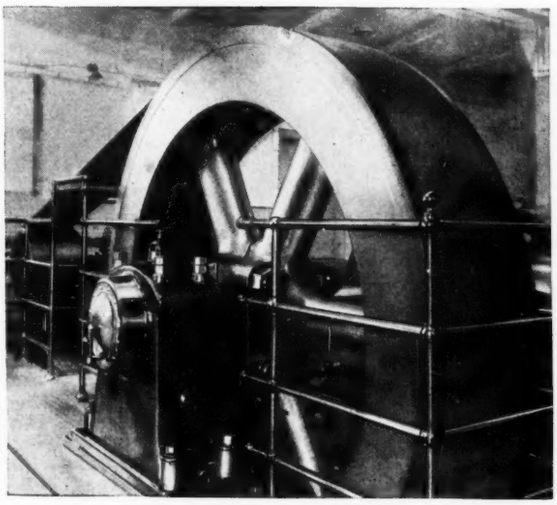
The "rough" leather produced by these steps is next "curried." This process consists of working a predetermined amount of oil and fat into the leather. Before the currying compound is worked into the leather, the pieces are first soaked in warm water and scoured with a cleaning solution. The flesh side is then lightly shaved to remove any loose flesh and make it easy for the compound to enter the leather.

After this the leather is laid on tables and the compound applied to the flesh side. Then the pieces are again dried under controlled conditions. Following drying, another scouring is used, after which the leather is dried in a special press.

The final operations involved in preparing leather for belt manufacture are finishing processes called "setting

Fig. 1—Leather tanning and manufacturing plant of Graton & Knight Company, Worcester, Mass.

LEATHER BELT *Making*



Large drive employing leather belt

out," stretching and finishing with a rotary brush. The pieces are then ready for the processes used in making the belt, which involve cutting up into appropriate shapes, grading and forming into belts.

Steam, warm water, compressed air and electricity are among the power services used in tanning leather and making belts. Because of the heat used in the form of steam and hot water for carrying out the processes, it is possible to generate electric current, at least sufficient to meet part of the plant needs, at a lower rate than this current can be purchased.

How the Services Are Supplied

The power house at the Graton & Knight Company's Worcester plant contains five boilers. Four of these are B. & W. boilers of 3,000 sq.ft. of heating surface each. These are operated at from 150 to 175 per cent of rating, 24 hours a day, except on Sundays when two or three boilers are operated to supply the steam requirements. The fifth boiler is a horizontal return tubular of 1,500 sq.ft. heating surface, provided with a dutch oven. This is used for disposing of tan bark and other refuse from the factory.

Steam is supplied to the engines at 175 lb. per sq.in. The factory steam supply is at two pressures, 100 lb. per sq.in. and 2 lb. per sq.in. The water-tube boilers generate 175 lb. steam, while the H.R.T. boiler operates at 100 lb. The plant uses 10,000 lb. of 100-lb. steam per hour, which exceeds the capacity of the H.R.T. boiler, so that 175-lb. steam is fed into the 100-lb. main through a reducing valve to make up the deficiency. This reducing valve is of 5-in. size. A steam-flow meter is installed to measure the amount of steam passing through it.

The greater part of the process work, as well as all the building heating, is done with 2-lb. steam. The higher pressure is used only where the low pressure will not serve. In some cases, for instance, where steam is blown directly into a vat, the stirring effect of the high-pressure steam is needed.

The engine room contains one Hewes & Philips compound Corliss engine, operating non-condensing and carrying a load of 900 to 1,000 hp.; one American Ball engine, direct-connected to a Westinghouse direct-current generator of 100 kw. capacity; and two belted generators, of 100 and 50 kw. capacity respectively. These last are driven from the Corliss engine jackshaft. In addition, alternating-current electric power amounting to 50,000 kw.-hr. is purchased. Two air compressors furnish compressed air for factory use at 100 lb. pressure. There are two hydraulic pumps with an accumulator, used to maintain a pressure of 2,500 lb. per sq.in. for the operation of belt presses, stretchers and other equipment.

Applications of Power Services

The 2-lb. steam is available in all parts of the factory. It is supplied from the exhaust steam from engines and pumps, augmented by live steam supplied through reducing valves which are set to maintain a pressure from 1½ to 2 lb. Steam is drawn from this system to heat water or solution in tanks, for dry rooms and for building heating. While steam at this pressure is just right for drying systems and heating buildings, there is more or less difficulty in using it to heat solutions in vats, especially where undesirable chemical action is set up due to the use of pipe coils. Some large vats are equipped with coils of brass pipe through which the 2-lb. steam passes, the condensation being trapped and discharged to a hot water tank. But it is expensive and complicated to equip all of the smaller tanks with such coils.

In tanks where the steam can be mixed with the contents, what might be called an ejector heater is used. In this the low-pressure steam, entering near the top of the liquid contents of the tank, is conducted through a short horizontal run of pipe. A vertical pipe, leading from near the bottom of the tank to a tee in the horizontal pipe, ends at a point just beneath the steam nozzle. This has been successfully tried, so far, in tanks up to 3 ft. in depth. It serves to heat the liquid evenly and rapidly.

The use of warm water in the factory is considerable and a supply at 120 deg. F. must be maintained at all times of the day or night except on Sunday. This water supply is stored in a waterproof concrete tank 24x21x14 ft., holding 50,000 gal. All the waste water from air compressor jackets, refrigerating machine condensers and elevators, which are run by water from the city mains, is discharged into this tank, where it is heated and then pumped to the factory for such purposes as washing and finishing leather. The tank being on the ground floor a pump is necessary to give the water the required head. This pump is a centrifugal of 600 g.p.m. capacity, running constantly against a head equivalent to 70 lb. pressure, and located on the level of the tank bottom.

To keep the water at a proper temperature a pipe is

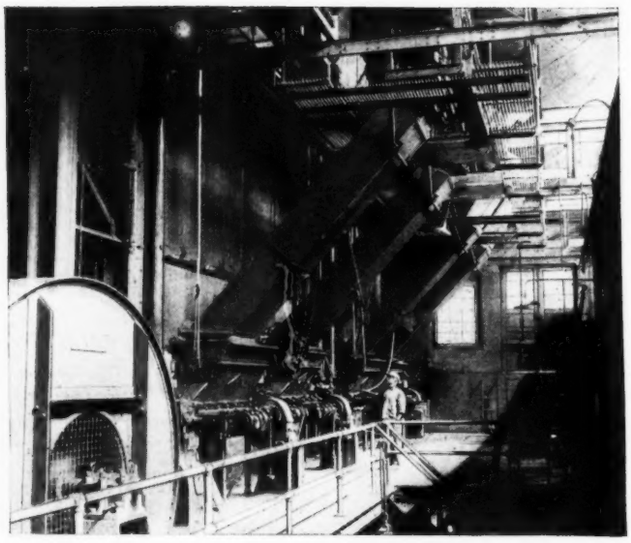


Fig. 2—Boiler room showing stokers and fan

connected in the discharge from the pump and run to an 800-hp. closed heater under the engine room, and from this heater back to a tank. By means of a globe valve in this pipe a varying amount of water is shunted through the heater to keep the water at the proper temperature in the tank, as shown by a hot-water thermometer attached to the tank. This is hand regulated, but as the tank is large, the temperature does not vary rapidly and it is an easy matter to hold the temperature of the water fairly close. The condensation from heating returns is also discharged into this reservoir, and as that is discharged at a temperature of 160 deg. F., it helps to heat the rest of the water. This warm water is all used in the tanning and currying process and averages 200,000 gal. per day. Heating this water naturally uses up a lot of exhaust steam, fulfilling our aim to do our work with exhaust and low-pressure steam whenever possible, as by that the cost of power is reduced.

There are many tanks, hot closets and grease kettles, where it seems to be impractical to use steam at low pressure. It is naturally easier to run a $\frac{3}{4}$- or 1-in. pipe into a vat from the higher-pressure line than to install a system of heating coils in the bottom of the vat, which require an outlet at the bottom of a return pipe to the trap, but if the steam saving that would accrue from using exhaust steam would overbalance the cost of installing a coil, the coil would probably go in. However, there are some other reasons why coils cannot be used in some tanks and one of these is that undesirable chemical reactions are set up due to use of pipe coils which are detrimental to the leather.

Jacketed grease kettles require hot steam for quick melting of the grease, but the amount of steam used is small. The high-pressure steam gives quick heating with a minimum of pipe coil.

Compressed air is furnished to the factory at 100 lb. pressure and piped to all parts, reducing the pressure where needed by regulating valves. This is used for spraying purposes, humidifiers, and agitating lime and other heavy solutions. The spraying is done in the usual manner, but the method of agitating lime solutions will bear a little explanation.

The stirring is accomplished by using a pipe lance by hand, connected to the air supply. The air is discharged at the end of the lance through a nozzle designed like a steam turbine nozzle, with expanding orifice. This form of nozzle gives the air the greatest possible velocity in a direction straight out from the pipe instead of expanding and shooting in all directions as soon as it leaves the nozzle. The throat of this nozzle is $\frac{3}{16}$ in. in diameter, is economical in the use of air and does the work satisfactorily.

Air is also used for temperature regulation, furnishing power for the operation of regulators and for boiler-tube cleaning, an air-driven turbine being used for this purpose.

Electricity is generated at 110 volts direct current and is used mainly for lighting, although there are a few motors, such as coal conveyors and crane motors and many small motors running office accounting machines which use direct current.

Alternating current is purchased at 550 volts and supplies power to about 300 hp. of motors at various points in the factory where it is convenient or impractical to drive by belt and shafting from the main engine.

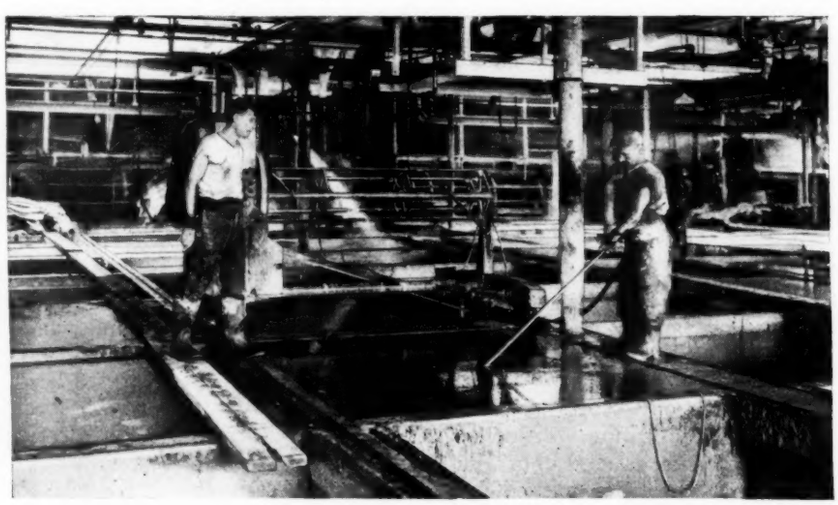
About 90 per cent of power in the factory is transmitted by belt drives and 10 per cent by electric power.

Unit Service Quantities

It is impossible to state exactly the amount of steam power, etc., used per unit of goods manufactured. About all that can be said is that there are approximately 1,000 hides per day, or 300,000 per year, made into leather and the production does not vary much from week to week. The steam consumption is much more in winter than in summer and amounts to about 100,000 tons per year, generated by 10,000 tons of coal and some refuse. The power generated and transmitted by belt drive is approximately 5,100,000 hp.-hr. per year (indicated at the engine) and that purchased amounts to 588,000 kw.-hr. This figures down to three hides made into leather per ton of steam generated or 30 hides per ton of coal. Also for power there are consumed 19 hp.-hr. for every hide used.

These figures are approximate as there are many dif-

Fig. 3—Agitating lime solution with compressed air lance



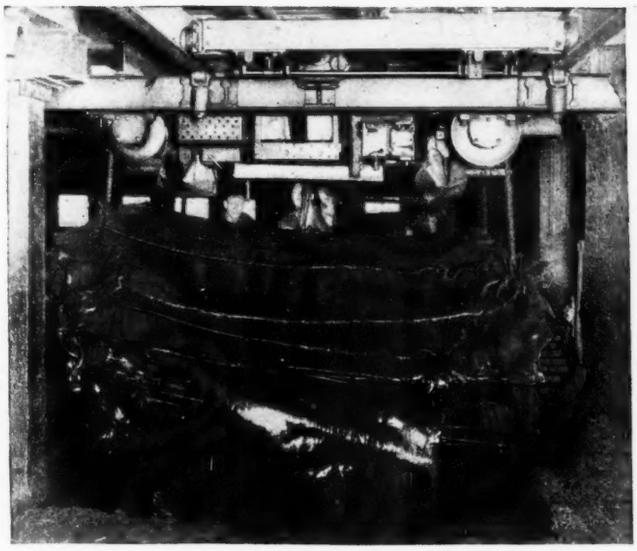


Fig. 4—Removing hides from solution with motor-driven hoist

ferent commodities made in the factory from leather, although belting is our main product.

There is considerable difference in the amount of coal consumed in winter and in summer, and no allowance has been made for that. The difference is due to colder water supply and heat needed for drying and heating buildings.

Division of steam for various departments was obtained from measurements taken by an indicating flow meter, and an estimation of the amount of power used by each department was made by observation, coupled with a knowledge of what power each machine would consume, together with the number of hours the machine was used per day. As every day is fairly typical of every other day, this method is considered fair enough for all departments, and as power is mostly by belt drive, it seems to be the only way it can be done.

The heat for the buildings is charged according to the floor space which is very approximate, but meets our conditions fairly well. The departments that have the most floor space use less heat per foot of floor space because the rooms they use have less exposed outside wall and window surface, but it is made up by warm air taken in drying by the same department. As this drying is not always the same—that is, the requirements for heat are not always the same—it is impossible even to estimate with any degree of accuracy the cost of heat used.

It might be well to say that the division of cost of steam and power between different departments is not considered important enough to go to the expense of buying expensive meters, as practically all the products made in the factory are sold finished, and the departments using most of the steam and power handle all the leather for the factory.

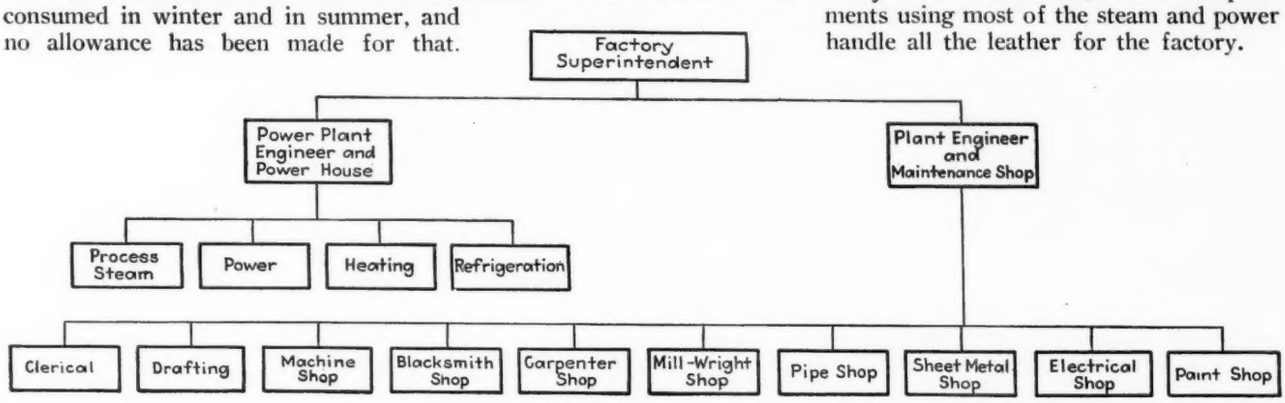


Fig. 5—Organization chart of power department

Home Was Never Like This

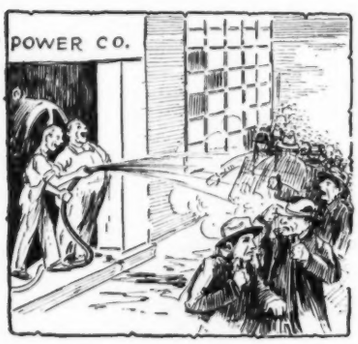
IN THE OLD DAYS the humid, dusty air of summer played havoc with the chocolate drops that Sally set on the window sill to harden. Today the power services have solved her problem. The modern candy manufacturer cleans and refrigerates the air in his plant and controls its humidity. Closely regulated steam heat replaces Sally's coal range. And with all due apologies to the "home-made" myth of sacred memory, the modern product is better. Next week's issue will tell how they work it at the Nunnally candy factory in Atlanta, Georgia, where power services safeguard production.

REMINISCENCES OF AN ENGINEER

By Hubert E. Collins

Finding Trouble and Shooting It

HARRY COLLIER had unconsciously imbibed romance while living his first nineteen years in the West, half of it on some of the last frontiers of romance and story. There he had found his share of excitement and had developed a system of quick action, which was of use in the chosen work of the rest of his life.



This manner of taking life as he found it bore him through the days of his early apprenticeship, even made a pleasure of bolt cutting. He rose as he mastered laying out and labored as a cub on repair jobs. With him real romance reached its heights when he had erected his first engines and was appointed to his first job as assistant engineer in one of the moonlight-schedule power houses in New York City.

The place, bordered by the East River on two sides as it swings through Hell Gate, was then in such a tough section as to bring excitement almost daily. It was the life for one who desired action. Harry took the job with anticipation, which was not weakened by realization.

As the company was operating under franchises secured from Patrick Jerome Gleason, there was to be no slip-up in operation. It called for continuous operation from the setting of the sun to its rise. This must be regardless of load furnished. If the plant was out of commission for fifteen minutes, the franchise could be revoked. This meant that Harry labored many days to prepare his units for service.

Another point was continuous maintenance of a specified voltage. The generators were the first alternating-current ones in the plant. This requirement of constant voltage led to Harry's first enjoyable experience. He had worked his engine into running condition in every respect but governing action; the engine would not control automatically, and new weights were needed from the shop. Before they could arrive, the superintendent notified the city that he was ready to serve. One 16-cp. lamp to light the entrance to a doctor's office all night was the extent of the load for a 500-hp. engine. There was nothing to do but obey orders. Harry started his engine, threw in on the line, and there and then inaugurated alternating-current service which has continued to this date over lines of the present New York & Queens County Electric Light & Power Company.

To govern the engine under the conditions, required someone at the lever throttle all the time it was running; that someone was Harry. What matter if he had worked during most of the daylight; he was young, and that was what he was hired for.

Nevertheless, the time came when the young man must get some sleep, so he delegated operation of the plant to the oilers and firemen. The throttle was operated from the lower deck of the engine, the deck being of cast iron with calks laid in geometrical order over its surface, each about one half-inch high. When the first relief came, Harry lay down to sleep on this deck surface, but he soon found it uncomfortable and had a pine board brought to lay over the calks, for they dug into his anatomy.

So well had this man become accustomed to the sounds of his engine, that any variation in speed would waken him and he would rise up to adjust the throttle so it held the voltage beyond criticism of watching eyes. Some service, Harry!

A marine engineer finally became chief; the boys called him Denny. Under this man, Harry, Billy, Steve, Mike, Pat and the rest of the crew worked at top speed and efficiency.

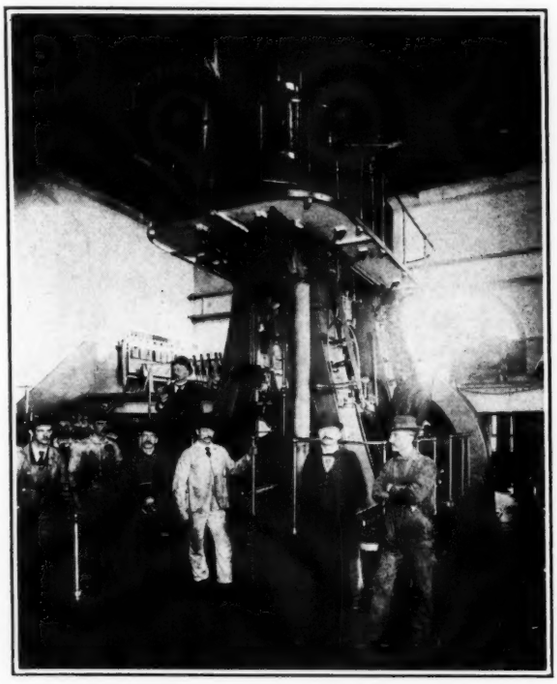
For some reason, there came notice from the Long Island City Court House that the water would be shut off the next day. Apparently, there was no room for argument. Lumber, cement, extra men were rushed to the power house. Everyone worked one long day and night under the direction of the resourceful Chief and accomplished wonders. The cellar of the plant was sheathed with planks and the walls raised so that an immense storage space for water was ready for use when the city water was turned off. Relays of tank cars started to bring water from the Newtown pumping station to the power house and dump it into the new reservoir. For several days the new service was a success and steam was generated as usual.

The enemy watched for a few days, as did the power-house gang.

Then there appeared a large gang of city workmen who started to work at digging up the water pipes where they lay under the surface of Mill Street from the ferry to the power house. One day they worked, on the second day the plan was revealed. The trench paralleled the track over which the tank cars brought the water to the power house. This railroad track took a sharp turn at the power house to pass into an alley where the tank cars were off the street, where they could unload without blocking

traffic. It was seen that as the trench being dug would pass under the tracks at the curve, the heavy tank cars would be spilled into it. The trench was not being dug to get at pipes; its purpose was to undermine the tracks and stop the water supply.

The news was telephoned to Manager Beetem, a man of active resource. He raced to the spot in a special car, which was run over the spot where the trenchers intended to go under the track. Alone the manager stood in his car with pistols in his hands, and ordered the workmen from their task. They poured out of the trench and ran down the street to telephone City Hall.



The first Williams engine in the Mill Street Power House of the Long Island City Electric Light & Railway in 1896

Policemen came, but the enraged manager defied them to enter the car and take him. The determined man held the fort and won the day as the boys in the power house filled windows and cheered.

The next move of the politicians was to prevent the men coming to work. They were beset by thugs on the way down Mill Street, or rather the thugs waited there. The boys saw them first, and knowing the neighborhood better, found other ways to get to work. Then came a ten-day siege of the power house with the men all sleeping there. Food was smuggled in and the place was prepared to repel attack from all sides. Pipes were run to every probable point of attack and hot-water hose lines were connected. The enemy would have had a very warm reception. Yes, Harry was enjoying the excitement; he was on another frontier.

The trouble with the Fighting Mayor abated somewhat after the ten days' siege. His Honor, defeated there, took to chopping down the approaches leading from the ferry house to the station of the Long Island Railroad.

The power-house force had its own means of engrossment. There was the drowning at the dock of the poor watchman derelict on the sea of life. The boys took up the collection which allowed him to be buried in God's Acre. Again they rallied to the memory of one who wandered into the station at night and fell on the big belt, being thus swiftly and expeditiously sent to the hereafter. Bob Lee left to go to the Spanish War via the Navy. Great was the day as the old monitor passed the power-house dock on its way to the Sound, there to repel the supposed attack of the Spanish Admiral, Cervera. On the deck, abaft the turret, huddled some of our brave sailors, among whom stood Bob, with a grin from ear to ear. Harry enlisted under S. McDowell McCook, of Civil War fame, to enter the cavalry. Alas! Teddy got the bulge with his Rough Riders, crowded all others out and the cowboy engineer remained in the engine room.

There was other excitement in the power station. A description of it will aid in understanding.

The station had contained belted railway units, of Corliss and high-speed engines belted to lighting units when Harry first came there with two vertical, direct-connected, condensing-engine units. These latter took the place of the obsolete high-speed horizontal engines. The power plant then had the two new Williams verticals, and two Fishkill Corliss engines belted to a jackshaft which in turn operated some score of old arc machines. All on this side was devoted to generation of current for light and power, called by the men "the light side." These engines were served by boilers in their own plant. The opposite side of the station, covering as much floor space as the other, was devoted to the generation of current for railways, by three Corliss engines belted to generators. The railway side also had its own boiler room. Between the two engine rooms was a gallery holding the switchboards for lighting and railway.

Those were the good old days when brawn counted in ruling the power-house gangs recruited from the marine service. Many of the first chiefs of New York City power houses were such by reason of their reputation for two-fisted action. Harry was a light-weight, ambitious to work up. Nerve, developed on Western cattle ranges, helped him equalize disparity of weight.

Harry rose to assistant chief engineer in this place and was a stickler for discipline during working hours. His men fell into line and were ardent followers of his leadership.

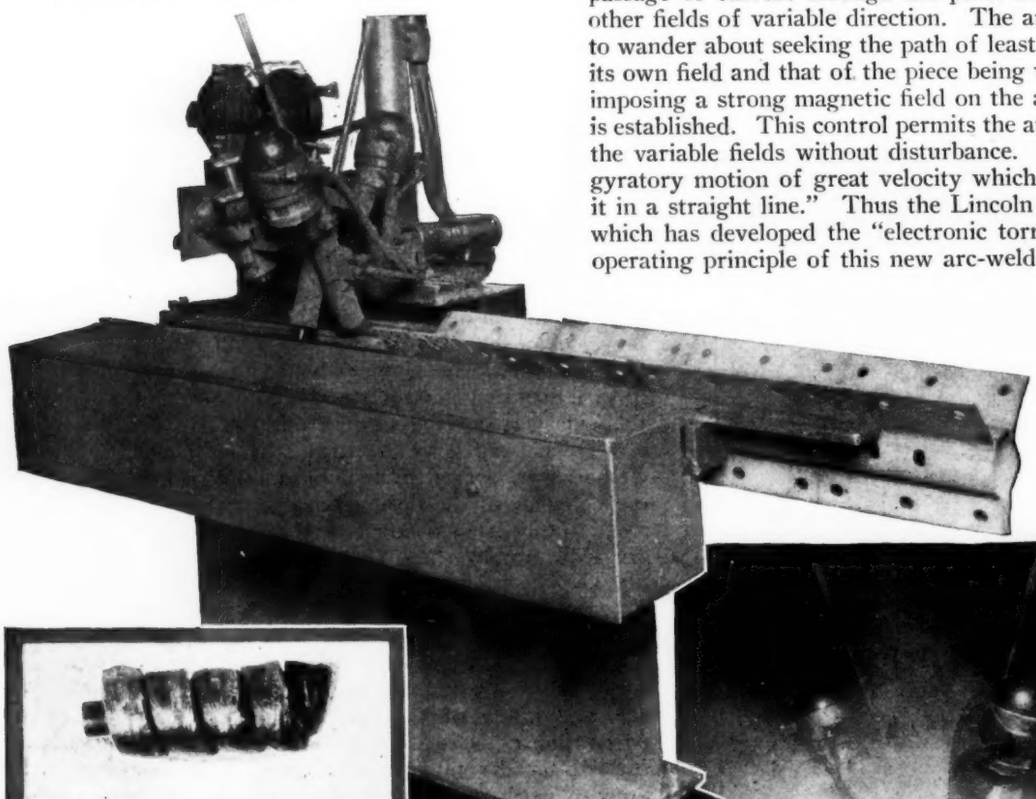
Holding Those Pressures

PIPE JOINTS were one thing in the days when 150 lb. steam pressure was good enough for anybody. Today they're quite another matter in many plants. Most engineers are familiar in a general way with the Van Stone and Sargol joints, but how many are familiar with all their variations and the reasons behind them. I. W. Whittle of the Southern California Edison Company will tell the story briefly and clearly in the May 10 issue.

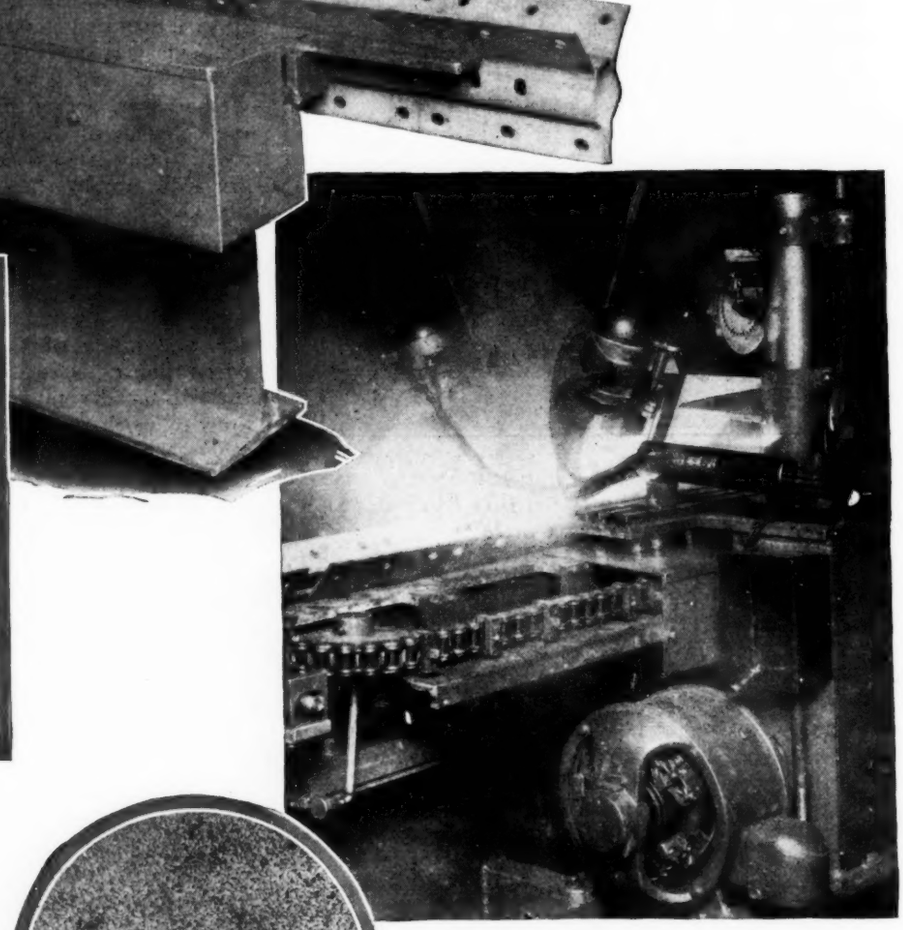
"Electronic Tornado" Welds Steel

Below—Double-headed "electronic tornado" machine set up to weld fins on an oil-well derrick clamp. The fins are first tack welded in place.

"THE electric arc is normally a difficult phenomenon to control. It creates its own magnetic field and, in the passage of current through the parts being joined, creates other fields of variable direction. The arc, therefore, tends to wander about seeking the path of least resistance between its own field and that of the piece being welded. By superimposing a strong magnetic field on the arc flame, a control is established. This control permits the arc to travel through the variable fields without disturbance. The arc is given a gyratory motion of great velocity which also tends to hold it in a straight line." Thus the Lincoln Electric Company, which has developed the "electronic tornado," explains the operating principle of this new arc-welding development.



Bending and twisting tests, like those shown above, indicate that the fused metal closely approaches the base metal in physical characteristics. This indication is confirmed by the micrograph of a weld section (right) which shows a fine and even crystal structure.



Above—"Electronic tornado" in action. Magnetic control prevents interference between the arcs from the two crossed heads. This machine is placing welds on the derrick clamp at the rate of 40 ft. per hour for each head. No filler rod is used; the arc fuses the fins and tube into a single piece.

"Am I interested in

POWER TRANSMISSION?

It's One of My Principal Jobs . . ."

"GOOD morning, sir! Yes, I'm engineer in this plant.

"Am I interested in power transmission? Well, rather. It's one of my principal jobs, starting with the coal pile or the power we make and carrying through to put it to work where it will do the most good. Yes, I'm interested.

"But I hope you're not one of those power transmission salesmen such as came in here the other day. You're not a salesman? But you'd like to hear about the one I refer to?

"Well, in came this chap with a duck covering for steel pulleys, the kind that glues on. The covering itself is good if it's put on just right. I've used it. But this chap had a story to tell and he did not bother to ask me if I had ever used a covering—started right in.

"He drew a cute little nickel-plated model out of his bag—a pulley, perhaps two inches in diameter by a one-inch base. It was mounted horizontally on a standard and was fastened to a pendulum that ended in a little weight. Half the surface of the pulley was covered with the material he had to sell. The other half was bare. I'll sketch the layout for you.

"He set the model on my desk and brought out about a foot of belt, half an inch wide, with a weight slung on the end. He laid the belt over the smooth side of the pulley, the weight hanging down, and pulled horizontally. The pulley turned until the pendulum weight was out of vertical about 30 deg. Then the little belt slipped.

"He said, 'See!' I said, 'Yes.' Then he moved the belt over to the covered half and pulled again. This time the weight came clear over the top, no slip at all.

"He said, 'See!' I said, 'How about the difference in arc of contact?'

"He said, 'Arc of contact makes no difference, what do you mean—arc of contact?'

"I said that pulling horizontally with the belt on the smooth side and vertically on the covered side was not fair because the arc of contact was double in the second case.

"He replied to that statement, 'Young fellow, I've been selling things to the trade since before you were born. Hope you don't make me go to see your boss.'

"'You'd better not see the boss,' I told him, 'because he's also an engineer and he'd also bob up with a line about arc of contact.' The upshot was that he did not sell any covering.

"Salesmen like that hurt the other men with power-transmission equipment. The fellow who buys, wonders how much sales talk he's getting along with his facts.

"I understand now, though, that the power transmission people are getting together and forming an association to collect the facts and give us engineers some real help.

"Oh, you are one of the investigators of this association? Well, now, they are getting down to facts. And you would like to go through my shop and have me tell you something about our transmission equipment?

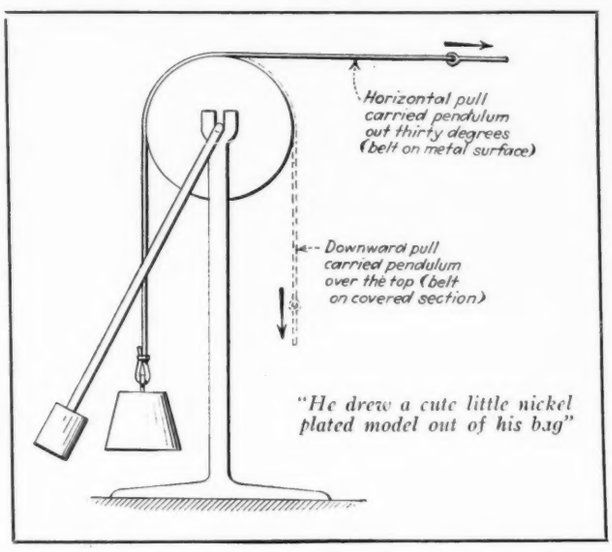
"I'll be glad to. We'll start right now—out this way.

"Here we are in the shear room. With the plant working in pressed metal for the most part, we do our blanking and shearing here.

"There's a blanking press yonder that will do 300 sq.in. at a whack. A 50-hp. motor drives it. As you see, the motor is strapped to the roof trusses. There is an 8-in. belt to the drive pulley, 15-ft. centers.

"That motor was mounted on the press when we first got it—on a big bracket up above the drive. It had about 6-ft. centers and an idler to get enough wrap on the motor pulley.

"Why isn't it that way now? It's because whoever designed that idler did not know very much about bearings or even idlers in general. The thing might have looked good on paper, but when it got to turning over, something better than a mile a minute, it threw out all its lubricants and shortly after was rattling all the windows. Ball or roller bearings might have helped the proposition, but the thing was a plain sleeve bearing, poorly designed.


Horizontal pull carried pendulum out thirty degrees (belt on metal surface)
Downward pull carried pendulum over the top (belt on covered section)
"He drew a cute little nickel plated model out of his bag"

"When we make a hit, there is something over 200 per cent load lands on that motor as the dies come down on the steel. It's only an instant and then there's a slap in the opposite direction when the tools 'break through' and all the weight of the ram is released. We were afraid the idler would hurt someone, so we changed the drive.

"There you have an instance of power-transmission

design that keeps us on our guard all the time. The principal trouble is that we can never seem to catch up. We'll not allow another such press drive, but that does not mean that something just as faulty may not pop up somewhere else.

"Oh, that's what you're here for! Well now, if you can help us, we'll certainly appreciate it. Work with you? You can count on me, for one, I'll promise you that!

"There's another drive over here that you may want to see. It's also an 8-in. belt on about 18-ft. centers. See the thing weaving sideways like a snake? Know why?

"A belt man told me that the leather in that belt was taken from the side of the hide, so it is weaker on one side than on the other. It stretched in the weak sections. He showed me also how to tell in general whether Im getting belts from the middle of the back or not. I asked him to give me the information for future reference.

"No, he did not sell us that particular belt, and I will say that the ones that he has installed run good and true.

"There's a 14-in. beauty in the next department on a 1,200-ton press. He put it on after a high-class combination outfit of two kinds of leather separated on us. We learn a lot of things about this shop by keeping our eyes and ears open.

"Lacing? We make our big press belts endless with glued joints. The smaller ones we lace with the little hooks and the rawhide pins except those that the men are liable to put their hands on.

"There's another point I can tell you about belts. We'll go to the machine shop.

"See that motor-to-line belt up there? It's tight as a bow string. It has to be to do any driving with the short centers and the difference between motor and line-pulley diameters.

"Why don't we use belt dressing? We do, as I'll tell you in a minute. The point I want to make is that we found a way out on some dozen drives like that around the plant. We are changing over now. Just look over on this side of the shop.

"Yes, I knew you'd like that. We found that we could buy the combination you see there complete and ready to mount our present motors on. It's a sort of 'back-gear' motor base. You see there is the base to mount the motor and a pair of standards to carry the back shaft. The motor is geared to one end of the shaft. The drive pulley goes on the other end. The geared reduction from motor to back shaft lets us put on a much larger pulley. The whole assembly can be mounted on rails for belt adjustment. We have specified a silent motor pinion and are using the pressed paper pulley. Altogether it's a dandy arrangement.

> *"Yes, we engineers are opportunists. We have to be to cover the run of our work and keep the plant wheels turning in the right direction."*

"The fact is that if you transmission people would pick up a few such things as that and show us how to lick the glaring misapplications of belt drives in general, you would take a lot of distaste out of belt drives. Actually, they are inexpensive and efficient if they are put in right and given fair attention.

"Attention—now there's a point we know a little about, thanks mostly to our belting-expert friend. Let me tell you what he told us about belt dressing.

"Many of our belts were badly dried up when he came around the first time. Many others were thoroughly oil-soaked. We were using stick dressing by the mile.

" 'The trouble,' he told us, 'began when your belts were first put on. Right then you should have given them a little drink of good liquid dressing. Then, with the pores filled but not soaked, the belt will not be on the way toward drying up. Likewise, it will have no room in those properly filled pores for oil and grease that may be flying around. Also, it will be developing its maximum of pull.

> *"The fact is that if you transmission people would . . . show us how to lick the glaring misapplications you would take a lot of distaste out of belt drives."*

" 'Apply a little more dressing from time to time without using too much,' he went on. 'Wipe a belt off with a little gasoline when the surface becomes glazed, but don't let the gasoline soak in. You have a man to watch belts. Use him, actually, to watch them. Give them a square deal and you won't be busy at all in making repairs.'

"More things he told us. Numbers of little items were pointed out. It all wound up with his statement that belts are like shoes. Keep them properly dusted and polished and they will not only last a long time, but will give excellent service while lasting.

"Speaking again of pulley covering, let me show you one of our air compressors. Here it stands, a 300-ft. machine, motor-driven. We had a lot of trouble with belt slippage on that steel motor pulley and were about to change it to one of pressed paper when our belt expert suggested that we first try covering the pulley.

"Clean surface, he told us, was the most important item with good glue running a close second. Then he gave us a demonstration of what he meant by clean.

"First he wiped the pulley with waste. Then he gave it a bath in gasoline. Next he used a blowtorch to cook out the pores in the steel, so he said. Finally he wiped the surface with a dry clean rag and was ready to apply the glue.

"He spread the melted glue with a brush over a small section and started the covering on right away. He went all around then, keeping the glue just ahead of the covering.

"That covering has been in place for two years now, in use every day, and it shows no signs of loosening. Yes, there's practically no slippage.

"But here, we've been going about the shop forgetting all about time. I'll take you to our restaurant before it closes, and we'll have a bit of lunch. Then we can start out again.

"Interested? That's fine. Anything we can do to help your very constructively organized association we're glad to do. For we will benefit along with everyone else.

"As for me personally, it's a pleasure and a benefit. Looking for points of interest for you has brought up several ideas for me that I am going to put to work.

"Yes, we engineers are opportunists to a large extent. We have to be to cover the run of our work and keep the plant wheels turning in the right direction."

WHAT DO YOU KNOW?

By L. H. Morrison

The answers are on page 1028

AN ENGINEER recently said that he found he could answer less than 50 per cent of the questions asked in this column. So he wondered if they should not be simpler. If an engineer can answer all the questions, he is wasting time in doing so. But even the "knowing" one may find that he "knows wrong," for most of our knowledge is a mass of opinion tied together by a minimum of fact. Then, too, the editor may answer wrong—think of the pleasure you can find in "calling" him.

Ques. 1—Why are ferrules sometimes placed around boiler-tube ends before the tubes are rolled into the sheet?

Ques. 2—What special precautions are necessary to take if a centrifugal pump is installed so that the suction lift is 35 ft. above the water level?

Ques. 3—What is meant when one says that there is a draft of 2.3 in. through the fire bed?

Ques. 4—Gasoline is lighter than water. Why, then, will not a pump lift gasoline as high as it will water?

Ques. 5—Where is the Walschaerts valve gear most used and what are its advantages?

Ques. 6—What is the difference between a straight low-pressure turbine and a mixed-pressure turbine?

Ques. 7—What is the difference between duplex and dual drive of steam station auxiliaries?

Ques. 8—Why is it impossible in a bleeder turbine to extract all the steam?

Ques. 9—What is the air consumption of an adult?

Ques. 10—At what specific gravity does sulphuric acid and water electrolyte have the lowest electrical resistance?

A Woman's Opinion on Democracy in Business

By Celia M. Hobbs

DEMOCRACY is often quoted in this America of ours, but just how much is it practiced? So little in college life that the real value and purpose of secret societies are being seriously questioned in the periodicals of the day—and all too rarely in business, if an incident that came to my attention recently is any indication.

A young engineer, of good family, college-bred, always working for the interests of his firm, and irreproachable in character, was alone at his plant one day, when in walked three of the "big guns," as the plant personnel jocularly styled the men of higher position in the firm.

These three men made a leisurely inspection of the plant, but their gaze traveled over the young engineer, greasy, but alert and interested, as just so much more machinery. The local official did concede him a nod—when the young engineer spoke first. Not a thought of an introduction with a few words of explanation as to the purpose of the visit or of congratulation to the young man for the neatness of the plant, the savings he had made for the firm, his interest in the company's affairs.

A single remark might have made the man feel that his work was worth while, that it actually does pay to be honest, resourceful, and all the other attributes that men who have "arrived" are so profuse in demanding of employees, but so chary of approving when they acquire men of such characteristics. And so the officials went out in their unthinking way, leaving a man, if not sullen, at least dispirited, with just a little less pep for his firm and his job, just a trifle inclined to wonder "What's the use?"

If every man higher up, or, in other words, a little farther along, would just remember that young men in their firms are potential executives, possibly they would exercise slightly more tact and friendliness in their attitude toward such employees. Even if they are doubtful of any such achievements by the "under dogs," it would not lessen their dignity any, nor their bigness, nor their reputation in the firm generally, to concede the right of every man, as long as he is a man, to plain, every-day courtesy.

We need not discuss what far-reaching effects such attitudes have on the whole economic scheme. Sufficient it is to consider their effects on the individual. Few workmen want the misplaced philanthropy of a Pullman, and they may not appreciate even the generosity of a Ford, but not one fails to respond to a simple man-to-man attitude on the part of those for whom he puts in a good one-third of his life.

Color Enters the Coal Pile

The recent outbreak of vivid coloring in pots, pans, refrigerators, gas stoves and other domestic paraphernalia, ushered in by the advertising slogan, "Color Enters the Kitchen," seems to have induced emulation on the part of the cellar. At least, the familiar black diamond of the house-heating furnace is now blossoming forth in bright cerulean hues.

This new departure is due to the enterprise of the Glen Alden Coal Company, which has devised a means for dyeing its high grades of Lackawanna anthracite a bright blue. For some time there has been a movement on foot for the labeling of coal so that the consumer can be sure that he is getting the desired fuel. So far this movement has not progressed to the point where it influences the power plant to any great extent. But it may be that we are entering an era when rainbow-tinted or otherwise trade-marked coals will indicate for the purchaser the quality of the fuels he buys.

High-Pressure

Flash-Type Accumulator

By C. M. GARLAND
C. M. Garland & Company, Consulting and Construction Engineers, Chicago

Designed primarily for high pressures, with the water divided up into large areas of small volume, this accumulator flattens out sudden and intermittent demands for steam, such as are imposed by steam hammers, hoisting and rolling mill engines, maintains a uniform load on the boilers and reduces the boiler capacity otherwise necessary for this class of work.

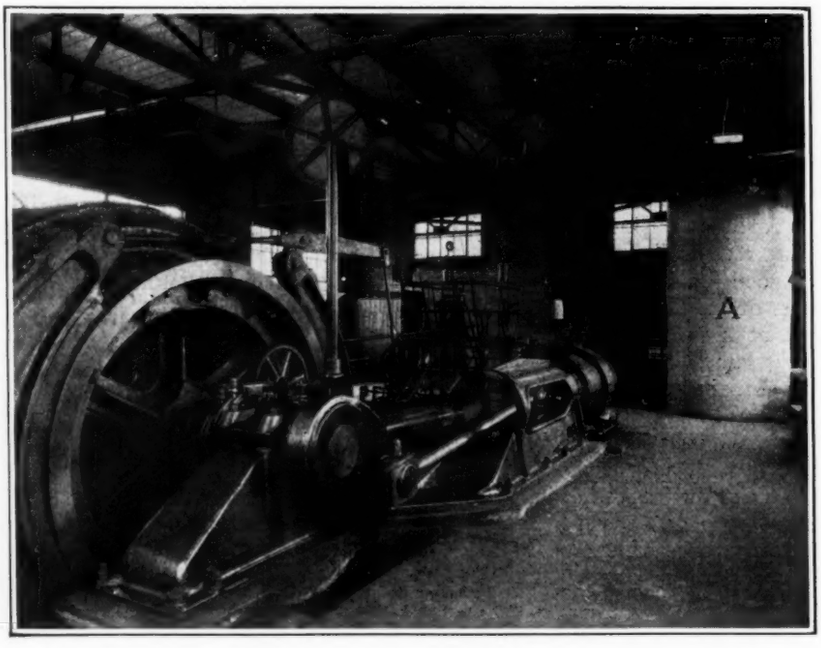
THE flash-type accumulator is designed primarily for use in flattening out the sudden and intermittent demands for steam made upon boilers by the operation of steam hammers, hoisting engines, rolling-mill engines and such equipment. Although it may be used for low-pressure work, utilizing the exhaust steam from such equipment as has been mentioned, it is best adapted for high-pressure service, as it is more expensive in construction than the accumulator of the Rateau, Ruth and other types that store large quantities of water in single shells or compartments.

Owing to operation at high pressures it is necessary that the diameter of the shell be maintained within reasonable limits, 6 or 7 ft. at the most, to avoid the use of very thick plates with a resulting increase in the cost of manufacture.

As the name indicates, the flash-type accumulator is designed for instantaneous operation. In other words, it must supply large quantities of steam over a few seconds, and also in an equal period of time be capable of condensing steam sufficient to supply the demand. In addition to this it must be so designed that the sudden demands will not draw water out of the accumulator into the pipe line, which would bring certain disaster when operating under high pressure. These three conditions require that the body of the water be divided up into large areas of small volume. In the type designed by the writer, which is shown in Fig. 2, the accumulator consists of a steel shell, in the present case 72 in. in diameter by 18 ft. long. This shell contains a large number of shallow trays carrying water to a depth of approximately one-half inch. The trays have an opening in the center through which a perforated pipe *B* passes from the bottom to the top of the shell. Steam is admitted at *D* to the perforated pipe.

In operation this type of accumulator ordinarily is connected to the steam line between the boilers and the equipment requiring the intermittent supply of steam. It is advantageous to have the accumulator as near to the equipment utilizing the steam as possible, so as to avoid losses in the pipe line. The accumulator is connected off to one side and floats on the steam line, with a throttle valve and a stop valve ordinarily placed between the accumulator and the line. It is well understood that the operation of the accumulator depends upon a drop in the pressure of the steam. For example, in the accumulator shown at *A* in Fig. 1, which is used to flatten out the demand on a boiler plant supplying steam to a hoisting engine, the normal boiler pressure is 200 lb. per sq.in. and the engine takes steam at the rate of 60,000 lb. per hour. The hoisting engine is designed to operate and pull the load on a pressure of 150 lb., although it is made sufficiently

Fig. 1—Accumulator (A) installed in an Illinois coal mine



heavy to withstand a pressure of 200 lb. It operates for a period of 12 seconds and then is down for a period of 12 seconds.

This sudden demand at the rate of 60,000 lb. per hour for a 12-second period is disturbing to the water level in water-tube boilers, and for this reason in mine plants

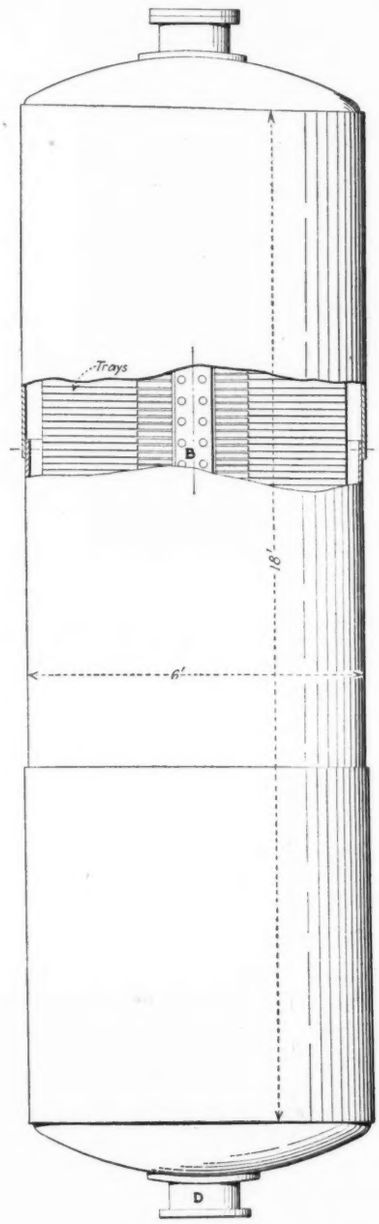


Fig. 2—Flash-type high-pressure accumulator

it has been customary to install a large number of return-tubular boilers so as to provide storage for large volumes of water. This necessarily means inefficiency in operation and high labor and maintenance costs. For the elimination of this condition in power plants the flash-type accumulator was designed. In the case previously referred to, the accumulator was designed to deliver steam at the rate of 30,000 lb. per hour during the period when the engine is operating and to condense steam at the same rate when the engine is not in operation. This means that the boilers operate at the practically uniform load of 30,000 lb. of steam per hour.

The accumulator was designed for a maximum pressure of 200 lb. per sq.in. and for a minimum pressure of 175 lb. At the beginning of the operating cycle the engine starts under a pressure of 200 lb. By the end of the working period the pressure in the accumulator has dropped to 175 lb., and in dropping through this range, water in the accumulator is evaporated at the rate of 30,000 lb. per hour. The pressure on the boilers, however, remains at 200 lb. When the hoisting engine stops, steam at 200 lb. pressure enters the accumulator, which is under a pressure of 175 lb. The result is condensation of the boiler steam at the rate of approximately 30,000 lb. per hour, so that when the hoisting engine is again ready to start up, the accumulator has the necessary stored-up energy and the pressure has been restored to approximately 200 lb. gage.

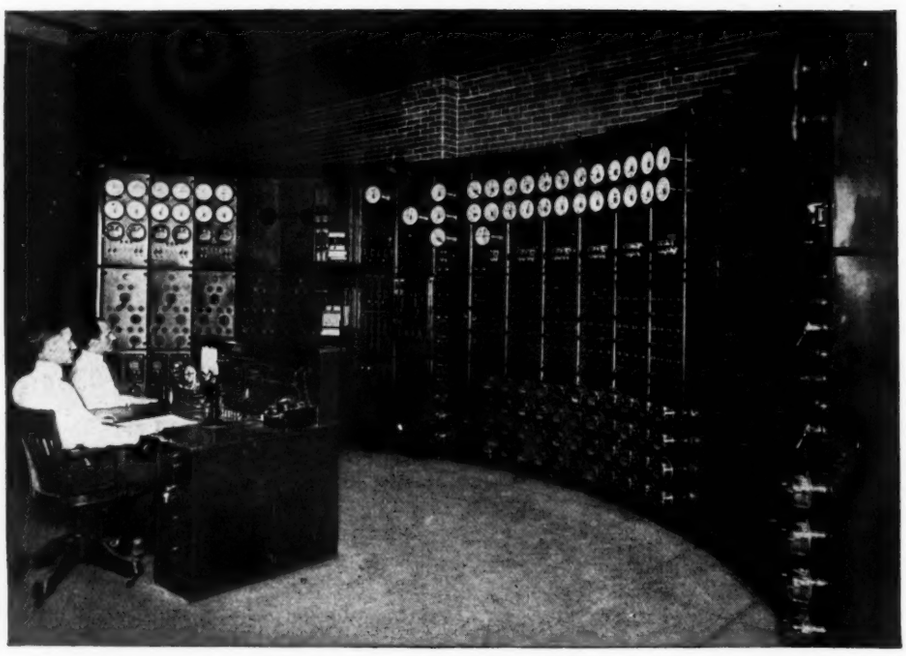
A stop valve is placed between the accumulator and the line, and a throttle valve is placed in the line between the boilers and the accumulator. This throttle valve may be adjusted to maintain an approximately constant pressure on the boilers, while the steam pressure in the accumulator and that going to the engine fluctuates between 175 and 200 lb. per square inch.

Action of the accumulator makes possible the use of water-tube boilers of any size, whereas previously boiler plants furnishing steam for such service were limited to a large number of inefficient return-tubular boilers. In addition to this the accumulator cuts down the boiler capacity required, as boilers cannot operate at high ratings under a rapidly fluctuating load of the nature previously indicated. In a boiler plant costing approximately $175,000, two of these accumulators were installed at a cost of $15,000, and saved in round numbers $70,000 that otherwise would have been necessary for additional boiler capacity. The accumulators can be built in any size and for practically all pressure conditions.

Business Must Purge Itself

"Unless business purges itself of those who flaunt the law and abuse their power, the public," declared Judge Edwin B. Parker before the annual convention of the U. S. Chamber of Commerce, "will turn loose thunderbolts of wrath which inevitably will bring legislative and governmental regulation of business to a degree that will seriously hamper a legitimate freedom of business initiative. Stockholders of corporations have the duty of publicly repudiating those who misrepresent them by amassing profits through corruption.

"It is the function of Government to deal with crime. But there is a twilight zone between acts which are illegal and criminal on the one hand, and acts which are simply unmoral on the other. Those whose conduct falls within this zone, whose acts, while within the law, are repugnant to the public interest, must be branded as social outlaws."



All equipment on the switchboard can be seen from the operator's desk.

Selecting CONTROL EQUIPMENT *For Oil Circuit Breakers*

By Stephen Q. Hayes
General Engineer, Westinghouse Electric & Manufacturing Co.

THE earliest electrical power plants containing a few machines of small output at moderate voltages were easily controlled from switchboards where all the switches, meters, and other devices, were placed on panels. As the voltage and output increased, it became necessary to utilize more space for the switching devices and to operate them at a distance by suitable means from a central point.

For the smaller plants manually operated remote-control circuit breakers were utilized, but where the distance between the switchboards and switching devices or amount of power or high voltage made the application of hand-operated breakers questionable, electrically operated breakers were used.

In the field of power-operated oil circuit-breakers other than the type FH line of the General Electric Company and the motor-operated breakers for alternating-current control made by the various builders, electrical-solenoid method for closing is now used almost universally in America. The electrical solenoid type of operation is flexible and the standard electrical mechanism closes the breaker by a direct-current magnet and holds it closed by a latch, a trigger or a toggle which engages automatically. The tripping mechanism consists of a direct-current trip magnet acting on a trigger which releases the latch trigger or toggle permitting the breaker to open. The closing and tripping circuits for the mechanism are operated by a control switch, with or without control relays in the closing circuit and usually with signal lamps. All electric operating mechanisms have the equivalent of a double-throw switch to open up the control circuit when the circuit breaker opens and to operate signal lamps.

In addition to the main oil breakers, field switches and exciter switches, electrical operation is usually provided for the field rheostat, speed governor motor and occasionally for valve motors and similar devices.

In the consideration of control switches and control wiring, the source of the control energy and the arrangement of the various circuits are important matters. The amount of energy required for the closing coils of solenoid operated breakers varies from approximately 5 kw. for the smaller breakers to as high as 60 kw. for the larger ones. The time demand is short, not exceeding $\frac{1}{2}$ to $1\frac{1}{2}$ sec., and maximum energy demand about fifteen kilowatt-seconds.

Most of the control apparatus now in service has been

designed for use with 125-volt direct-current control circuits, although 250, 500 or any other available direct-current voltage may be used. In generating stations the exciter bus has been used sometimes as the source of the direct-current control supply, but where a voltage regulator is employed, it causes the voltage of the exciter bus to fluctuate, and it is preferable to install a storage battery in order to have constant operating voltage. This battery is usually charged from one of the exciters, a small motor-generator set, or by using suitable resistance in series with a higher-voltage direct-current circuit.

When considering the arrangement of control wiring, due attention should be given to the following features:

All control circuits should be arranged so as to be protected, in so far as possible, from any high-voltage or any other power circuits.

Two or more sources of power for the control circuits should always be available. The standard arrangement usually contemplates receiving power from a storage battery, usually 60 cells giving a nominal 125-volt supply.

In important plants various control circuits for different breaker structures should preferably be segregated. Thus for a small double-throw system it would be desirable to have at least two separate control circuits, one for each busbar. In a larger system, where there is usually some natural grouping of breakers, there should be a separate circuit for each group. Each circuit should be protected by its own switch and fused for more than the maximum current demanded in closing the largest breaker. This gives protection in case of short circuits in the control system and yet assures a supply of current, in the normal operating conditions.

REQUIREMENT as to the power used in operating circuit breaker; the voltage and source of power selected for control circuits; size of storage battery; size and type of charging set for control batteries; kind and size of control wiring used and the system of identifying the individual wires are some of the questions to which the author gives the answers.

Where control circuits have not been segregated, trouble has occasionally been encountered. Several cases are on record where high-tension voltage has entered a single control-bus system and has prevented the operation of all switches, either closing or opening, with consequent disastrous results. The cost of segregating the control system is slight and such segregation should be made, partly at least, in every electrical remote control station.

Except in very large stations, it is usually found satisfactory to rely on a battery alone as a source of control current. There is required a small trickle-charge motor-generator set for charging the battery. After a considerable number of years of experience with oil-circuit-breaker batteries the principal battery manufacturers are recommending the trickle-charge method of keeping these batteries in proper working condition rather than the periodic-charge method which was more prevalent in the past.

The trickle-charge method is also known as the floating system. In this system a small motor generator is operated continuously except for periods when it may be necessary to shut down for inspection and maintenance. Under normal conditions the motor generator carries a steady lamp load due to the signal lamps and also supplies a small amount of charging current to the battery in order to keep it fully charged at all times and ready for service. This machine is of a shunt-wound type, having a decidedly drooping characteristic, so that, when a heavy demand occurs, due to the closing of an oil circuit breaker, the battery takes the major portion of the load. The machine is thus protected against excessive momentary overload.

Generally speaking, except for very large breaker installations, with long runs between the battery and oil breakers, a 125-volt nominal control circuit is employed, requiring 60 cells. The trickle-charge generators are designed with a maximum charging voltage of approximately 2.3 volts per cell, or about 140 volts for the 120-volt normal battery voltage.

The normal floating voltage value of a 60-cell battery is 129 volts, and by limiting the rated voltage of the trickle-charge generator to 140 volts, the operation at normal voltage is much improved and battery end cells are not required, so that the operation of the battery is simplified. In determining the size of the trickle-charge equipment, its rating in watts should be made equal to the product of the voltage (140) and the sum of the currents required for the indicating lamps and other devices requiring a continuous current, plus one-seventh of the ampere-hour discharge rate of the battery. Such a set would be the smallest one recommended, and in some cases larger sets would be preferable, particularly where the steady load is rather large, as this will permit the generator to run at appreciable load on the normal floating condition. For the connection between control switches and the circuit breakers and other devices which they control, it is customary, in American practice, to supply multiple conductor cables, each conductor being provided with a distinctive braid to facilitate checking the wiring after it is installed. This multiple conductor cable is usually made either with a fireproof braid or with a lead cover and is frequently run in iron conduit.

For small solenoid operated breakers the closing coil leads should have a cross-sectional area equivalent to 19,500 circ.mils; tripping coils and indicator leads equivalent to 6,000 circ.mils. The return circuit is of the same size as the closing coil leads and may be either in the same cable or in a separate one.

For very large oil circuit breakers on control circuits of 125 volts, it is sometimes considered advisable to use a heavier closing lead. In every case it is advisable to check the drop in the closing circuit carefully to insure proper operation of the breaker, as in some cases heavy leads will be required. When a relay switch is used at the breaker, the closing lead from the control switch is made only large enough for the operating current in the relay switch, and for this purpose a wire of 6,000 circ.mils cross-section is usually adequate.

In the multiple conductor cable each individual conductor is insulated for 600-volt service and is covered with a braid with an identifying color. The insulated

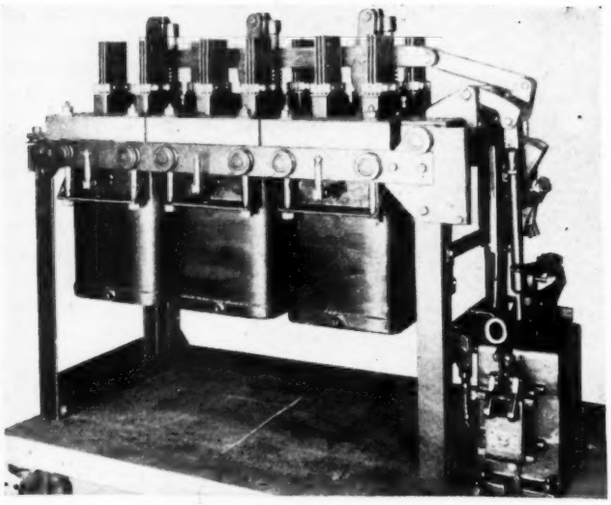


Fig. 2—Solenoid-operated medium-voltage oil circuit breaker

conductors are assembled and covered with a layer of tape or an outer braided covering or lead sheath. The outer covering selected for the cable depends on the nature of the installation.

The colors used by one manufacturer in identifying the individual conductors are as follows: First, black; second, white; third, red; fourth, green; fifth, yellow; sixth, blue; seventh, yellow and green. For example, four-conductor cables require the use of the first four colors, black, white, red and green braids.

When conductors of different sizes are used in the multiple conductor cable, the distinction in colors given above is followed in the order of their capacities, the largest conductor having a black braid and the next smaller one a white braid, etc.

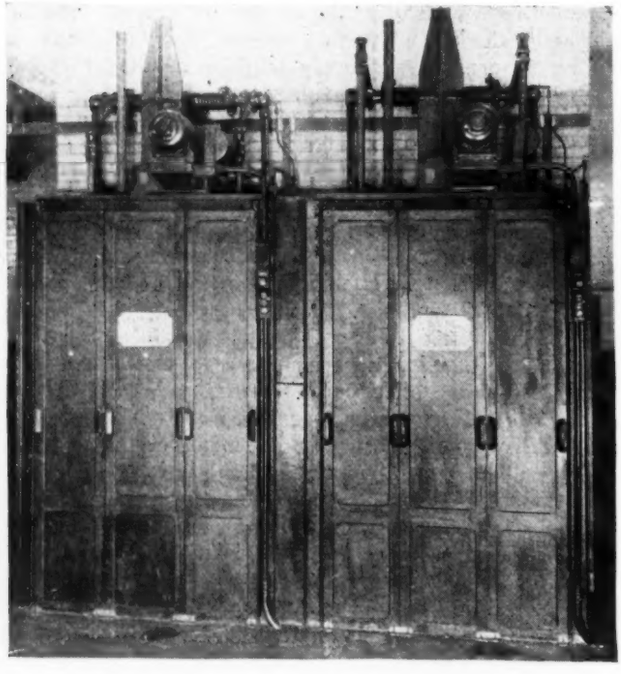


Fig. 1—Motor-operated oil circuit breaker

Why Blame the Motor?

By C. T. Baker

THE article by E. S. Baxter, in the March 13 issue, on "Why Blame the Motor," describes a condition that exists in far too many plants and one that is costing the owners a lot of money.

Some years ago I was asked to investigate the cause of high power costs in a flour mill, as the owner was strongly of the opinion that the power company's meter was at fault.

The first move made in the checking up of this situation was a careful checking of the power meter which was made with a rotating standard of known accuracy. This test showed that the power company's meter was reading high, approximately $\frac{5}{10}$ of 1 per cent. This held good for tests made with the plant fully loaded, as well as a test made with friction load and with about 50 per cent of the machines in operation. Tests were also made of the voltage, which was found to be correct for all conditions of load.

After making the full load test on the motors, a friction test was made to determine what percentage of the total load was absorbed in overcoming friction of the lineshafting, belts and the various machines running idle. It was found in the case of a 75-hp. motor that the friction load amounted to 60 per cent of the total, while that of a 20-hp. motor was found to be 65 per cent of the total load.

In looking for an answer to this abnormal condition, it was found that most of the friction load in each case could be traced to the condition of the shafting and bearings. The shafting was badly out of line and out of level. The bearings were of the old-style cast-iron babbitt-lined type with oil holes in the top cap into which a little oil was poured once a day by a laborer, just before the mill was started.

The bearings contained no oil reservoir or ring oilers, consequently they ran warm most of the time. Both the shafting and bearings were badly scored. There were three flanged couplings on the main lineshaft of the flour mill, which, in revolving, described an eccentric motion, and since this shaft was supported from overhead, being in the basement, nothing had ever been done to correct the condition brought about by the settling of the floor which had resulted from overloading with heavy machinery.

It was found also that there were a great many belts being run as tight as fiddle strings in order to prevent slipping, and on investigation it was discovered that the belts had not been receiving any attention, also that they were full of dirt and dust and in some instances not heavy enough for the power they were required to transmit. In other cases extreme pulley diameter ratios between the driving and driven pulleys had been used, which contributed to belt slip.

Taking it all in all, it was one of the worst cases of neglected power-transmission machinery that I have ever seen, and it was not at all surprising to find the power bills excessive. For a number of years the management had been raising a fuss with the power company about excessive charges and incorrect meters, while during the entire time the trouble had been caused by gross neglect of the mechanical installation.

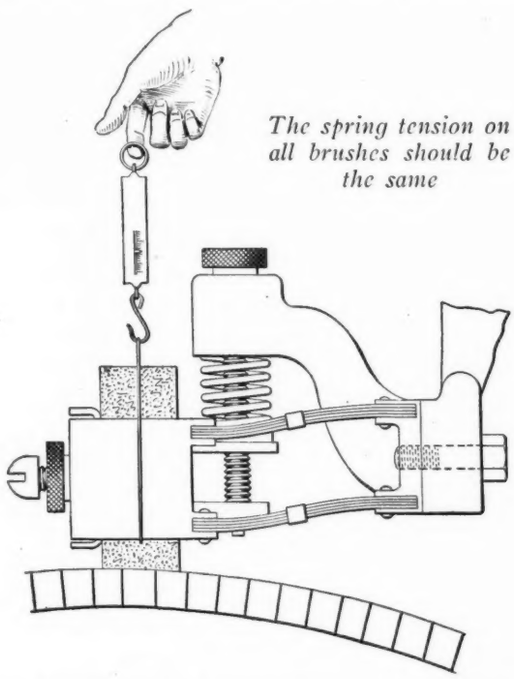
The owner was quite disappointed to learn that the high power cost was caused by conditions in his plant and was not the fault of the power company.

Electrical Applications

Good Operation Depends on Properly Fitted Brushes

By W. E. Warner

BRUSHES used on electrical machinery are of various grades and composition, but those used on any one machine should all be the same. The resistance of all brushes should be identical, or the current will not



The spring tension on all brushes should be the same

be equally distributed among them. If the brushes in one holder are of different resistances, those with the least resistance will carry the largest current, which may be in excess of their safe carrying capacity. If the brushes in the different groups are of unequal resistance, the group with the least resistance will carry more current than the others and the armature will be electrically unbalanced.

The spring tension on all brushes should be the same, as the pressure with which a brush bears on a commutator also affects the resistance. This tension may be measured with a spring balance; as shown in the figure. Fitting the brushes to the commutator also needs attention. When fitted in the usual way by pulling a strip of sandpaper under them, the strip should be pulled only one way with the tension on the brushes in the direction of rotation. If the tension is maintained when the strip is pulled back, the brushes will have a backward movement, depending on how good a fit they have in their holders. This backward movement tends to destroy the true fit to the commutator.

I have found that a good way of finally fitting the brushes is to mix some fine crocus powder with oil, put a little of this on the face of the brushes, replace them on the commutator and rotate the armature slowly until a surface is formed on the brushes. The brush gear and commutator should afterward be thoroughly cleaned.

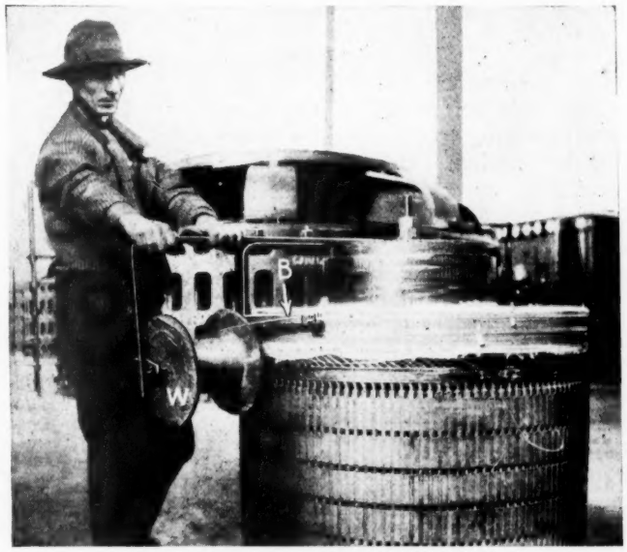
It is important that the brushes bear over their whole surface or their carrying capacity will be decreased and their resistance increased. An examination of the surface of a brush that has been fitted and the machine has been running for a short time, will sometimes show that the tip or heel is polished most, indicating that they bear hardest at certain spots. Sometimes part of the surface is not polished at all, indicating that it is not touching the commutator. A properly fitted brush will develop a polished surface over its whole area. If this is not obtained, it is generally due to the brushes not being properly fitted or to pulling the sandpaper strip backward as well as forward and the brushes being a slack fit.

Easily Made Tool for Banding Large Armature

By Charles S. Fynney

WHERE an armature can be swung in a lathe or mounted so that it can be rotated, the banding wires can be easily put on by holding a tension on the wire while the armature is rotated. I recently had to put the wire bands on the armatures of the exciter for an 8,000-kva. hydro-electric unit. This armature was removed from its shaft, so that it could not be mounted and rotated.

As shown in the figure, the armature was set on end and a form made of iron bars to carry the spool of band wire and to hold the tension on the wire. The device is centered on the armature by a bolt held in the center of the spider. This bolt passes through a hole in the end of an iron bar that extends out and is bent down to form the outer support for the wire reel *W*. To form the inner support for the reel, another piece of iron is bent L-shape and bolted to the first. A bar *B* is attached to the inner support of the reel carrier and has on its free end two pieces of fiber clamped together by two small bolts.



Bands being put on the armature

The banding wire passes between the two pieces of fiber, and the tension on this wire is adjusted by the strain on the bolts holding the fiber. The bands are put on by pulling the reel support around the armature and guiding the wire in place on the band. This job, including making the banding rigging and putting on the bands, required about three hours' work.

A Heart-to-Heart Talk

By R. E. GIBBS
Chief Chemist
York Ice Machinery Corp.

Taking the Corrosion Curse From the Ice Tank

ALTHOUGH obsolescence plays no small part in depreciation in an ice plant today, it is undoubtedly true that the greatest single item of depreciation is due to corrosion.

Some idea of the saving to be secured by properly controlling the various factors of corrosion can be grasped by an example of ice cans only. A 100-ton plant having a can ratio of fourteen cans per ton will have some 1,400 cans. The useful life of these cans, under average conditions, may be as high as ten years. This means a can depreciation of 140 cans a year which, at $6 a can, will be $840 a year as the apparent depreciation on cans alone. If the proper precautions are observed from the very beginning, can life will be indefinite. Thus, able supervision and examination of the involved factors will promote a considerable monetary saving.

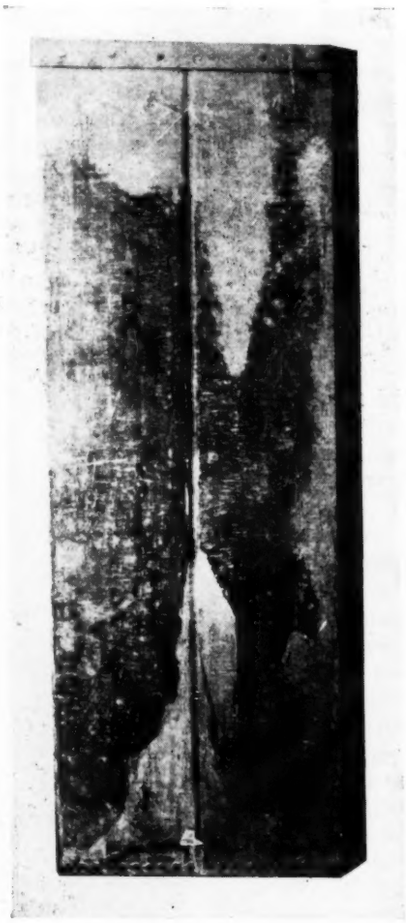


Fig. 1—The darkened areas on the can were caused by a too-alkaline brine

For economic and other reasons there will be found, in the usual refrigerating plants, brines made with calcium chloride, sodium chloride or calcium - magnesium chloride. The last is known commercially as "mixed" chloride. For ice making, where brine temperatures not lower than zero are to be maintained, salt brine is quite satisfactory. However, even under these conditions some prefer to use calcium chloride because of the lower freezing points attainable with solutions of this salt. This is usually done for the sake of safety, especially where brine coolers of the shell-and-tube type are installed, since with high-freezing-point brines there is a possibility of "freezing up" and bursting the tubes of the cooler. For the low-temperature work, below zero, required in various processes, either calcium chloride or mixed chloride is used.

Regardless of which of these solutions is considered, they are similar in at least one important property—each one, in the form used, is an excellent conductor of electric currents. And herein lies the basis of certain corrosive tendencies of these solutions. It is not going too far to say there is an immense field for a material to replace the common brines, provided it has approximately the thermal and physical properties of the common brines and, in addition, is a relative non-conductor of electricity. There is no suitable material of this sort economically available at the present time.

The chemical condition of the common brines, when newly made, is rather characteristic, although depending somewhat on the water used in making them. If the water is not exceedingly alkaline or acid, the newly made sodium brine will be very close to neutral and the mixed chloride brine also will be nearly neutral. But newly made calcium chloride will be in a decided alkaline condition.

This high initial alkalinity of calcium chloride brine is due to the free lime which the solid calcium chloride contains, and which the manufacturers have not succeeded in completely eliminating in the commercial processes of producing calcium chloride.

Corrosion tests clearly show that neutral sodium and calcium chloride brines have about the same value as corroding agents when any of the commonly used metals are immersed in them. Mixed chloride, on the other hand, is decidedly more corrosive to these same metals, especially in the range of specific gravities usually found in practice. With neutral sodium and calcium chloride brines, the corrosion of zinc is inversely proportional to the dissolved salt content of the brine. That is, as the specific gravity of the brine is increased, the amount of zinc corroded will decrease. Mixed chloride brine behaves to the contrary. In the limits of specific gravity met with in practice, the corrosion of zinc is proportional to the dissolved salt content, the higher the specific gravity the greater is the

action on the zinc and the loss of coating is increased.

The importance of this behavior should be recognized by all who are interested in the economical operation of refrigerating plants where brine is used. The specific

Fig. 2—A malleable-iron flange ruined by stray electric currents

gravity of salt brine should never be allowed to go below 1.15 at 59 deg. F., while for calcium chloride and mixed chloride it should not be less than 1.20 at 59 deg. F. There are some who prefer the lighter brines because of the smaller amount of power necessary to circulate them. This view, however, is probably one that is penny wise and pound foolish.

Bearing in mind that the chemical condition of brines can be divided roughly into three divisions: acid, neutral and alkaline, it is best now to consider the behavior of the various metals in solutions having these characteristics.

There are quite a few metals and alloys used in the construction of the brine-handling system. In the freezing tank will be found steel, cast iron, malleable iron, zinc, brass and solder. Extraneous to the freezing tank are steel, cast iron, bronze and brass. These metals and alloys are affected very differently by alkaline, acid and neutral solutions and this is shown in the chart below.

	SOLUTION		
	Alkaline Action	Neutral Action	Acid Action
Steel	slight	slight	decided
Cast iron	slight	slight	decided
Malleable iron	slight	slight	decided
Zinc	decided	slight	decided
Brass	decided	slight	slight
Bronze	decided	slight	slight
Solder	slight	slight	slight

It is seen that although some metals are admirably suited to the service, others, apparently not so well behaved, are used in their stead in different places. It will also be noted that the neutral zone is, to strike a happy medium, the most desirable. In any new plant, therefore, the brine should be almost neutral, or very slightly alkaline before the cans are placed in the tank. Any infringement of this fundamental requirement will result in the ruin of the galvanized surfaces of the cans so exposed and in a short time they will rust. Whereas, if the brine is maintained only slightly alkaline, the steel and iron surfaces are amply protected and the galvanized surfaces are protected to the greatest possible extent.

The full protection of the zinc-coated surfaces is due to only one thing, the protective coating or film created on the surface when this surface is subjected to certain conditions which are moderately corrosive. Some details on this point will not be amiss, since the formation of protective coatings is a subject of considerable importance and the results of great value to those who are confronted with problems of corrosion.

Zinc is a metal peculiarly well fitted for the application to which it is put, as a coating for the steel base of the ice can, provided it is treated in a fitting manner. It is primarily used to prevent rusting of the underlying metal and admirably serves this purpose so long as there is enough of the coating.

If steel and zinc are in electrical contact and in the same solution, so that a complete electrical circuit is formed, the steel will be protected at the expense of the zinc. It is only when the zinc is almost completely removed that the steel will rust to any appreciable degree. Properly cared for, however, the zinc offers protection not only to the steel, but to itself.

Zinc will corrode, to a greater or less extent, in any solution of acid, alkaline or neutral condition. It has been found, however, that in neutral or only slightly alkaline solutions the corrosion, over a period of time, is a minimum.

The explanation of this is simple. In highly acid solutions the product of the corrosive action forms a solution with the corroding medium, so that a clean metal surface is continually offered for further action. In highly alkaline solutions there may be formed an insoluble corrosion product, but it is formed so quickly that it does not adhere to the surface from which it is formed. In neutral solutions the action is at a minimum and the essential corrosion product, zinc hydroxide, clings tenaceously to the very metal itself. In the ice plant, where there is an alternate exposure of these lightly corroding surfaces to air which contains carbon dioxide and to a properly conditioned brine, this slow-forming film of zinc hydroxide is gradually carbonated to a firm and

Fig. 3—A gray-iron elbow from which electric currents took the iron, leaving it graphitized

Fig. 4—A graphitized gray-iron elbow

adherent protective coating of basic zinc carbonate. If proper conditions are maintained, this complete protective coating will be formed from a small amount of the zinc

on the sheet, so that there is a reduction in the thickness of the actual zinc coating. At this point of the fully formed protective coating there are some who recommend raising the alkalinity of the brine to protect the steel and iron work of the tank. This procedure should not be carried out for the reason that should any of the protective coating already formed be chipped or worn off, no new coating will form on this spot and in a short while the entire can will be affected. By maintaining the brine

Fig. 5—Electric currents ruined this gray-iron elbow

constantly in a slightly alkaline condition, *p*H 7.5 to 8.5, ample protection is offered to the steel and the conditions for forming and re-forming the protective zinc coating is assured.

Referring back to the previous description of initial brine conditions, it is now easily understood why the recommendation is made to have the calcium chloride brine, which is always highly alkaline when first made up, neutralized before the cans are placed in it. Undoubtedly, the first two weeks of the can's life are the most important period of its useful existence; it is during this stage that the ultimate life of the can is determined.

It is conceded by authorities that to foster long can life the brine should be constantly neutral or only slightly alkaline. But the question of how to maintain the proper degree of alkalinity has not been rigidly established. Some recommend muriatic acid to correct a highly alkaline condition, and some recommend sulphuric acid, while others recommend weak organic acids, such as acetic acid, found in vinegar, or carbon dioxide which, in water, forms a comparatively weak acid.

Advantages of Carbon Dioxide

The writer's preference is carbon dioxide for various reasons: First, it is desirable to form a protective coating of basic zinc carbonate on the cans. The addition of any acid but carbonic will not only reduce the possibilities of this coat forming, but actually reduce the carbonate in the brine to almost zero in value. Secondly, the use of strong mineral acids, such as muriatic or sulphuric, or weak organic acids is risky, even in the hands of the most experienced. Even a very slight acidity due to such strong reagents, acting for a short time only, will prove detrimental to the can coatings. If the strong acids are added slowly, there is danger of too much time elapsing before the alkalinity is sufficiently reduced. These dangers are not attendant when carbon dioxide is used. In addition, carbon dioxide is harmless and convenient to use. The commercial grade, so easily obtained, is suitable in all respects. The drum can be easily carried to the places where needed, set in some unobtrusive corner and the gas led to the proper location by rubber hose or tubing.

The proper place to add any corrective agent is in the agitator trough; that is, immediately before the agitator. A thorough mixing with the brine will result. With carbon dioxide it is especially desirable to keep the gas in contact with the brine as long as possible.

Introducing the CO_2

A convenient method for introducing the carbon dioxide into the brine is to use a piece of $\frac{1}{4}$-in. pipe about six feet long, connecting one end by rubber tubing to the CO_2 drum, the open end being inserted to the tank bottom and as close to the agitator inlet as possible. The incoming brine draws the gas with it through the propeller blades and thence through the various channels of circulation. The arrangement is shown in Fig. 7. The flow of gas should be so adjusted that when the opening of the pipe is in a suitable position, no gas bubbles will find their way to the surface of the brine in the immediate vicinity of the agitator. It is true that not all the CO_2 introduced is effective; some of it is lost. But its cheapness and convenience counteract any objections on this score. The theoretical amount of CO_2 needed can be calculated from an appropriate brine analysis, but this will not hold since some of the gas is not effective in the brine but is lost to the atmosphere. Practice alone will demonstrate approximately how much will be required. It is best, under these conditions, to test the brine every few hours during the addition of the CO_2 and cease the addition only when the alkalinity is at a proper value.

Condition of Brine Changes

In connection with freezing tank brines it is interesting to know that the condition of the brine, especially a new brine, does not remain fixed. Usually, it will be found that even though the brine was neutral initially, the tendency is toward a higher and higher alkalinity until a *p*H value of 9.5 to 10.5 is reached, where it will remain

Fig. 6—Parts of ten flanges eaten by stray electric currents

practically constant for some time. This increasing alkalinity is caused by the solution of zinc hydroxide which has formed from the zinc on the cans and is the product of the inevitable corrosion of this zinc. The distracting feature of this result appears to be the accelerated corrosion of the remaining zinc. In other words, the product of corrosion behaves in such a manner that it speeds up the disintegration of its parent. This action can be counteracted only by the continued addition of CO_2 during this period. Once the protective coating is formed, there is little danger of this increasing alkalinity

taking place. Actually, the tendency will be in the other direction; that is, toward acidity, and care must be exercised to assure a not too acid condition of the brine, which may cause the iron and steel work to rust.

Carbon dioxide is beneficial in correcting the alkalinity due to ammonia leaking into the brine. The alkalinity created by ammonia is sufficient to remove the zinc from the cans in a short time. Tests have demonstrated that by neutralizing an ammonia contaminated brine with CO_2, the corrosion rate of zinc is reduced to that of ammonia-free brine.

Ammonia leaks should be repaired as soon as possible, and the ammonia in the brine should be neutralized at the earliest moment. If this ammoniacal alkalinity is

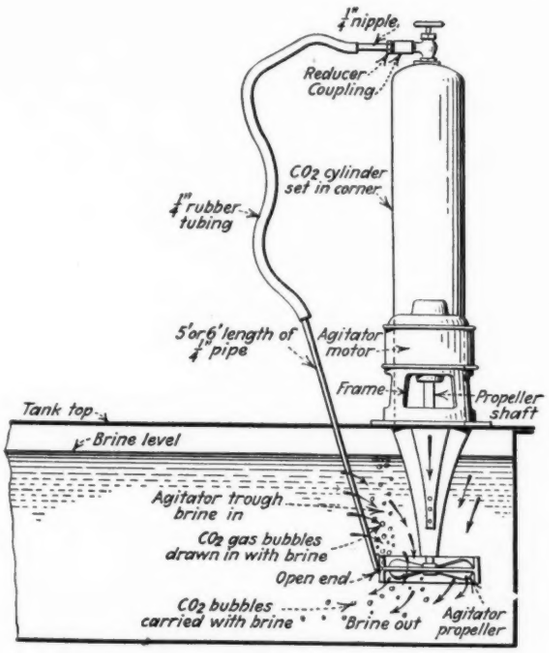


Fig. 7—Method of introducing CO_2 into the brine

allowed to persist for any length of time, the brass blowing tubes in contact with the brine will become porous and therefore put the can out of commission until repairs can be made.

The correction of acidity is accomplished in the same manner as for alkalinity, with the exception that an alkali is used instead of an acid. Lime is to be recommended since its carbonate is insoluble and thus does not give an alkaline reaction which is produced by sodium carbonate, the result of CO_2 and aqueous caustic soda.

Brine Seldom Dangerously Acid

It might be stated that a dangerously acid brine is seldom met with unless it has been brought about by some incompetent endeavor to correct excessive alkalinity. The evil effects of an acid brine, with the acidity usually encountered are rusting of the iron and steel, with dirty looking cans as a consequence of rust in the brine.

There are countless articles on the market for clearing such rusted brines, removing rust from the cans and coils, and cleaning up the tank in general. In almost every instance an examination of many of these materials disclosed them to be a concentrated solution of sodium silicate, or water glass, to which had been added a small amount of some soluble chromate such as sodium chromate. The benefits derived from the application of such materials are doubtful. They make things look better, but this is no criterion of their value to the materials affected. It has been definitely proved that sodium silicate in brines, and any value it may have is in salt brine only, increases the tendency to pitting of both zinc and steel. This is a feature that should be seriously considered before taking any definite steps toward its use.

Although little has been said up to this point on the corrosion of the steelwork in the freezing tank, there is little need to say anything on steel under the heading of corrosion factors that affect zinc detrimentally. The steel and iron are generously proportioned, and if the condition of the brine is such that the zinc coating of the cans is not seriously affected, the iron and steel will certainly not be affected to any appreciable degree. There are factors, however, that do control the usefulness of some of the equipment.

Cast-Iron Casing Deteriorates

One of the most unaccountable happenings of this sort, in the opinion of the layman, is the deterioration of the cast-iron casing of a centrifugal brine pump. The cause of this deterioration can be laid at the door of only one thing, the bronze impeller. Why such design persists is open to speculation. Our present-day knowledge should outlaw any such arrangement of bronze and cast iron as poor engineering practice. It was mentioned in the beginning of this article that all brines are excellent conductors of electricity. This property of brines, coupled with the fact that the various metals have different electrochemical potentials, is the ready explanation of this deterioration. The bronze of the impeller is electronegative to the cast iron, just as cast iron is electronegative to zinc. The inevitable result is the accelerated corrosion of the electro-positive metal. But in the instance of the cast-iron pump casing there is only a shell remaining of the former sturdy casting—it literally crumbles to the touch. This is what is called graphitization. The actual metal of the cast iron has been dissolved out, leaving nothing but the other major constituent of cast iron, graphite, as a fitting monument to the cause of poor engineering practice. No brine treatment will counteract this action. Such trouble can be eliminated only by making the impeller and casing of the same material.

Also, it might be mentioned that at times a brass valve in a brine line will separate from the steel pipe to which it was at one time threaded. The same action spoken of has caused this.

Stray Electric Currents

Another serious cause of accelerated corrosion is stray electric currents. Very few plants in towns or cities are entirely free from their destructive action. The most apparent action is on the fittings in the tank. Cast-iron fittings are graphitized and malleable iron or steel fittings are literally chewed to pieces. The brines of such tanks are usually highly alkaline and rust colored. In these cases no brine treatment will prove of the least value. The only possible step toward relief, if the source of these unruly currents cannot be done away with, is to bond thoroughly the points of ingress and egress with sufficient low-resistance copper cable to shunt the current past the tank and other affected equipment.

IDEAS FROM PRACTICAL MEN

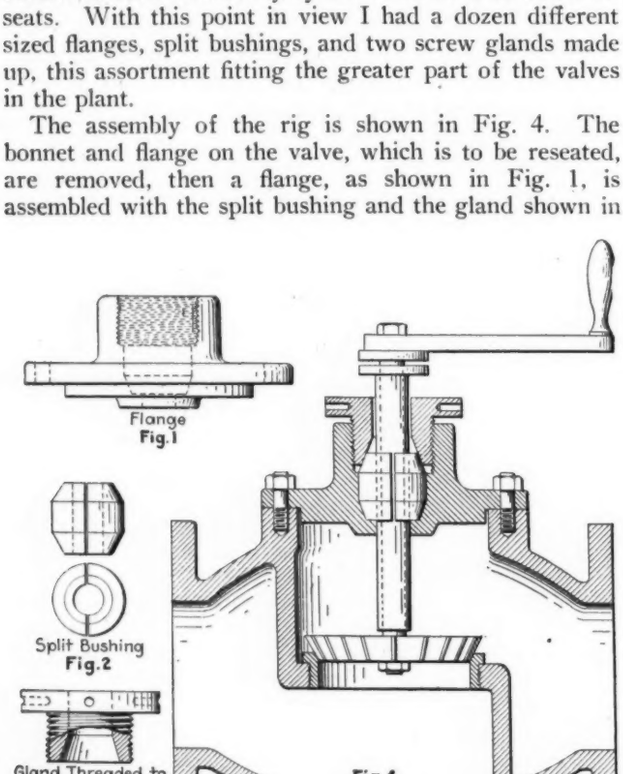
For the exchange of practical information and ingenious expedients in operation and maintenance of plant and equipment

Self-Centering Valve-Reseating Machine

RECENTLY, I had charge of a power plant that was badly run down. Considerable work was required to put the main engines and auxiliary machinery in good operating condition. Nearly all the cutout valves in the department leaked badly and needed regrinding.

In planning the work required I found that it would be necessary to utilize the services of all the skilled personnel available in the department for the main engine and auxiliary repair work. With all the leaky valves to be made tight and having only unskilled men available for this class of work, I realized from past experience that care in centering reseating machines was essential, otherwise considerable injury would be done to the valve seats. With this point in view I had a dozen different sized flanges, split bushings, and two screw glands made up, this assortment fitting the greater part of the valves in the plant.

The assembly of the rig is shown in Fig. 4. The bonnet and flange on the valve, which is to be reseated, are removed, then a flange, as shown in Fig. 1, is assembled with the split bushing and the gland shown in



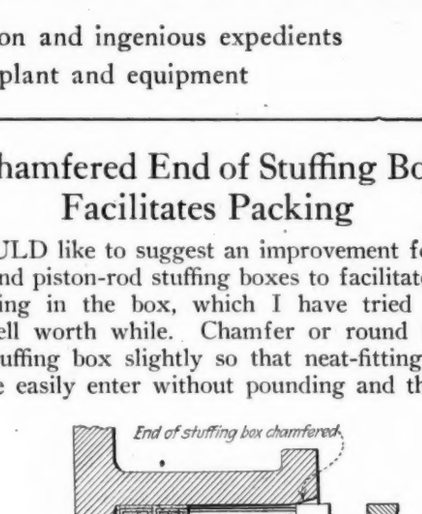
Reseater is centered by flange with special gland arrangement

Figs. 2 and 3. The spindle of a reseating machine is next inserted and a cutter secured. The assembly is then bolted to the flange on the valve, and the screw gland tightened, clamping the split bushing to the outer sleeve to prevent it from turning. This equipment insures the reseating cutter being properly centered and no danger of refacing the seat off center. With this rig, one unskilled man can reseat about four valves an hour.

Boston, Mass. EARLE S. NASON,
Chief Machinist U. S. Navy.

Chamfered End of Stuffing Box Facilitates Packing

I SHOULD like to suggest an improvement for valve-stem and piston-rod stuffing boxes to facilitate placing the packing in the box, which I have tried out and found well worth while. Chamfer or round the edge of the stuffing box slightly so that neat-fitting packing will more easily enter without pounding and the conse-



Section of stuffing box with chamfered end

quent danger of cutting the outside of the packing ring. The sketch will illustrate the idea.

It would also be a big help, it seems to me, to engineers in general, if steam-pump manufacturers would put the following data on the nameplate: Diameter of the rods, diameters of the stuffing boxes and the depth of them, diameter of the valves, size of hole and thickness of valve, together with the number thereof.

I keep a card record of these details and do not like to take a new pump apart to get this information, but I like to have the correct material on hand to make the repairs when needed and not have to wait several days to get it from the supply houses.

Collingswood, N. J. WILLIAM HEGARTY.

When to Blow Down the Boilers

IN A certain power plant where four 6,000-sq.ft. boilers were in use, it had been the custom to blow down each one at least one gage per day. We were convinced that a considerable saving would be realized if some provision were made for checking daily the concentration of water in each boiler so as to avoid unnecessary blowing down.

We considered titrating daily samples with standard acid or with a solution of silver nitrate, but finally decided on the purchase of a specific-gravity apparatus which would indicate accurately one ten-thousandth increase or decrease in the density of the water.

A sampling cock was accordingly placed below the globe valve on each water-column drain line. Daily samples were taken from each boiler and allowed to cool to the air temperature. In taking the specific gravity, we avoided the necessity of a temperature correction by

comparing the density of the samples with that of distilled water at the same temperature.

As no trouble had been experienced from priming or from the alkalinity of the water, we assumed that the average water concentration attained in the regular practice would be a safe minimum at which to start blowing down. For the purpose of a test we continued blowing only three of the boilers and allowed the other to be filled with fresh water, watching closely for a dangerous increase in concentration. The water in the boilers being blown showed no tendency to rise above what corresponded to about 700 or 800 parts of mineral per million parts of water, and in the boiler not being blown down the water had barely reached that concentration when the time for the regular bi-weekly emptying arrived.

After a month of careful testing we discontinued the daily blowdown entirely. We later found that once every two days was often enough to test the samples and that it was seldom necessary to blow a boiler between the regular bi-weekly emptying times. As to scale troubles, we believe these will be reduced also, for the chief scale-forming salt in the water is calcium carbonate. One of the peculiarities of this salt is that its solubility decreases as the temperature of the water is raised. It is thus evident that each gallon of hot water blown from the boiler will carry with it less of this particular mineral than will be brought in by the gallon of raw water required to replace it, for the raw water is saturated with calcium carbonate.

We believe the specific-gravity apparatus is more satisfactory than a titrating outfit would be, as it requires less skill for its operation and entails no periodic expense for chemicals. It cost only $24 and, with the proper care, should last almost indefinitely. M. F. KNOY.

Lake Charles, La.

Some Experiences with Air Lifts

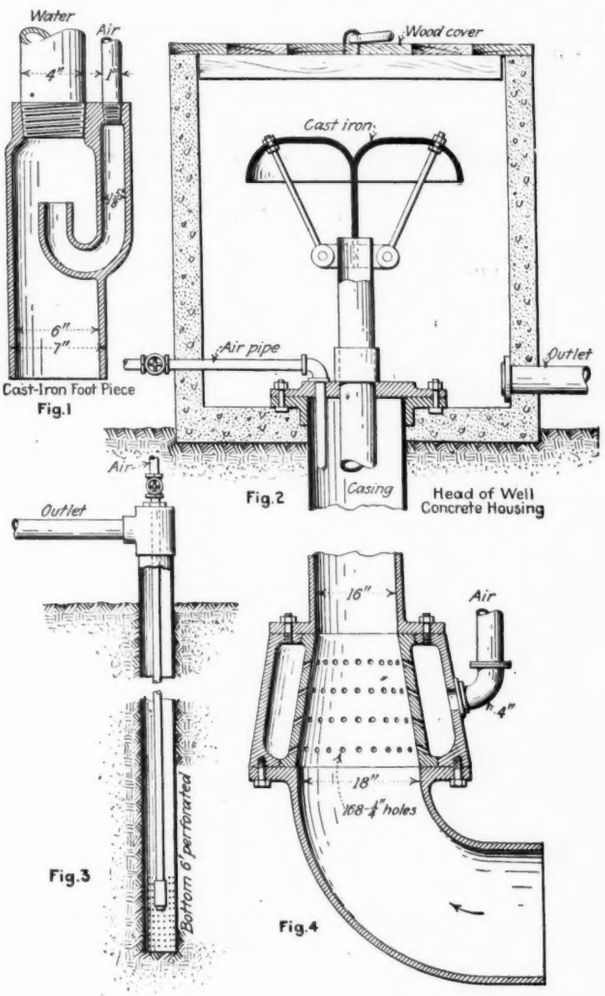
MY FIRST experience with air lifts was in Kansas, where water was pumped from shallow wells out of a sand-gravel formation. Here we had trouble from the casings collapsing, which no doubt was due to erosion and corrosion. The casings were originally much too thin and were finally replaced by galvanized standard-weight piping.

From Kansas I went to Ohio, where air lifts were installed to pump water out of a limestone strata, the wells being sunk to a depth of about 600 ft. and cased with 8-in. casing from the surface to the limestone.

When the wells were ready to be piped, tests were made at one of the wells to find out the most desirable footpiece to use, a number of which had been supplied by a manufacturer of air-lift equipment. The air consumed was indicated by a pitot tube, and the water was passed over a weir. The result of the test was that a home-made footpiece, as shown in Fig. 1, was adopted. The heads of these particular wells were like Fig. 2.

Soon afterward I was in Hankow, China, installing an ice plant for a Chinese company. To avoid pumping water from the near-by Yangtze River, I decided to install an air lift in the factory front yard. A 4-in. pipe was driven down about 60 ft., the top end standing above the level of the ground about three feet and fitted as in Fig. 3. The air for the trial was supplied by the ammonia compressor. On turning on the air, the water came up as black as ink. After a while it cleared a little, but was considerably less in quantity than was required, so I decided to force matters by repeatedly starting and stopping the flow, allowing the water to accumulate, then rapidly evacuating it. My purpose was to replace the fine material around the entrance of the pipe with coarse material, which is an effective way of increasing the flow.

A couple of tons of dirt was raised in this manner, but the flow of the well was not much improved. Our experiments came to a sudden end, owing to the ground around the head of the well subsiding several feet. My pig-tailed helpers were considerably alarmed, and I lost considerable "face" as a water expert. I was much relieved to find that the factory building was still intact,



Figs. 1 to 4—Footpieces and piping arrangement of air lifts

but decided then that it was unwise to install an air lift near a building resting on sand.

A pump was installed at the river, and the water was pumped into two large wooden tanks in which the silt, was given time to settle. The process was generally accelebrated by a coolie who vigorously stirred every freshly filled tank with a bamboo pole in the perforated end of which lumps of alum were encased. Another type of air lift is shown in Fig. 4. This manner of introducing the air is a good one for air lifts of all sizes.

The air lift has been so ably dealt with in *Power* by Frank Richards and others, that little remains to be written, at least about the theory of it. However, it occurred to me that my experiences may prove of value to other readers. E. J. JORDAN.

Long Beach, Calif.

COMMENTS FROM READERS

In which those who agree and those who disagree, with either authors or editors, are afforded an opportunity to express their views

Green Operators

REFFERING to the article in May 1 issue of *Power*, entitled "Operating an Ice Plant with Inexperienced Men," will Mr. Cunningham please give through *Power* a little light on who keeps up repairs in his inexperienced one-man plant? Also let us have some data on the efficiency of his plant. Does he furnish these very low-wage inexperienced or green men with roller skates so they can prove they are ambitious? C. D. DONAVAN.

Elephant Butte, New Mexico.

* * * *

Propaganda in the Schools

A MATTER of vital public concern, just now being officially developed in Washington, has almost entirely escaped public attention. I refer to the attempt of the electric utility corporations to control and corrupt the sources of public opinion in America.

The facts are being brought out by the investigation of the electric trust before the Federal Trade Commission in the sworn testimony, correspondence and accounts of the electric people. The investigation has disclosed that not even the schools are safe from contamination, and that every possible method of reaching and distorting the judgment of the public has been and is being used.

The purpose of this unprecedented attack upon the schools, which are the very foundations of democratic government, and the other sources of public opinion is to create in young and old a bias against the effective public control of the electric monopoly, and especially against the reduction of the extortionate rates charged to small and moderate consumers of electric current.

The method employed is to block with propaganda all the different avenues by which young people and the public generally might learn the truth about the extortion, over-capitalization and monopolistic practices of the electric public utilities. This propaganda begins, as the testimony of utility men shows, with the eighth grade in the public schools. From there it goes on into the high schools. In Pennsylvania, for example, 120,000 pamphlets were distributed free to high-school students in a single year.

Nothing and no one is neglected. Teachers in the schools are sweetened. The writing of textbooks on economics favorable to the utilities is procured, and their publication under supposedly neutral auspices is arranged. Passages in existing textbooks unfavorable to the public-utility point of view are eliminated through pressure brought to bear on authors or publishers. The adoption or rejection of textbooks is secured through school superintendents or other school authorities, as the interests of the utilities may dictate.

The censorship of schoolbooks goes so far that complete censuses of school texts have been carried out in several states, for the express purpose of making them tell a story that the public utilities would desire to have told.

Having covered the common schools and high schools, the electric propaganda goes farther into the colleges and universities. Professors receive secret subsidies to help them to see the electric problem in the electric way. "Safe and sane" investigations by "safe and sane" economists are liberally financed. More than one university has been paid tens of thousands of dollars a year to the same end of hiding the truth.

Never in the history of America has the like of this attack on the soundness and independence of education been uncovered. In attacking the integrity of the schools, it attacks the very basis of self-government. As an attempted threat to free institutions it is in the same class with the stealing of votes. And it is no less disreputable.

This electric effort to prevent our democracy from thinking for itself does not end with the schools and universities, but covers all the other sources of public opinion as well.

Subsidized writers, editors converted to safe views, canned news, canned editorials, sweetened news syndicates already punctuate the story, of which as yet but a small part has been told. Procured propaganda is sneaked into magazines, movies, radio, books, and even into government publications. Plans to reach clergymen are under consideration.

Chambers of Commerce are influenced, associations of bankers enlisted, organizations of women heavily assisted, Governors given money, members of important committees or conferences put on secret payrolls, ex-Governors secretly retained, ex-Senators hired, ex-Cabinet members are on salary, ex-Congressmen paid under cover to appear before committees without disclosing their employers, university professors on secret pay oppose bills the electric interests oppose, even a former Ambassador takes money for writings printed under another name—and all this in addition to attempts to buy a United States senatorship, and the other electric iniquities we knew about already.

And on top of it all comes the assertion of one of the leaders of the electric monopolists that all this is right and honorable, an assertion made immediately after he had found it impossible to remember under oath what he did with any part of some twenty thousand dollars of recent propaganda money—when he paid it, how he paid it, to whom he paid it, and what for.

This thing is nation-wide. In nearly every state in the Union—in all but five—the electric interests, by their own testimony, are carefully organized to do what is above described. They have also a special national organization to stimulate the state organizations and assist them, and a lobby at Washington which alone has just spent $400,000 in little more than half a year.

Finally, every cent of the money that has been and is being spent for these abominations is charged up as operating expenses, and you and I and all other consumers under the electric monopoly are paying part of the cost of debauching the schools and distorting the news and deceiving the people every time we pay our electric bill.

Milford, Pa. GIFFORD PINCHOT.

Removing Slag From Boiler Tubes

IN THE March 13 issue Richard N. Seldon asks how to overcome trouble with slag depositing on the bottom rows of tubes on an inclined water-tube boiler.

As is the case with many other problems, the most practical way, in my opinion, in which to solve the slag problem is to prevent it. In the long run it is easier to prevent slag than to remove it.

Usually, whenever there is slag, it is an indication of incorrect furnace design. Make the furnace large enough and install the baffles in the tube banks so that the gas velocity through the tubes will not be too high at any point, and slag troubles should disappear.

If the furnace and baffle walls are so arranged that the volume of the combustion chamber is small and the first gas passageway through the tube banks is small, it is obvious that the velocity of the gases must be high. The velocity is so high in fact that even the unburned gases are carried up into the tube banks, and after they get up there they cool off and will not burn at all. Combustion is therefore incomplete and slag is formed.

It is usually possible to move the bridge wall back and enlarge the combustion chamber. That is the best advice that I can give on the basis of what Mr. Seldon states.

Newark, N. J. W. F. SCHAPHORST.

WE HAD a problem similar to Mr. Seldon's and overcome it by making the following changes: We installed an 8x16-in. inspection door with the top of door two inches below the front of the tubes and at the same angle and about twelve feet from the bottom drums. This is where the slag starts to form. We use a lance with air instead of steam, as it handles easier, and we blow once a day. We have never taken out a boiler to clean tubes from slag and have operated 90 days. Before we tried this three weeks was a limit and high stack temperature indicated a congested area on the tubes.

It is advisable to check the draft while blowing to save the lance. We find it necessary to withdraw the lance frequently, or it will bend with the heat. We use a 90-deg. ell on the end of the lance and bush it down to $\frac{3}{8}$ in. with a short nipple. A. J. SLOAN.

Buffalo, N. Y.

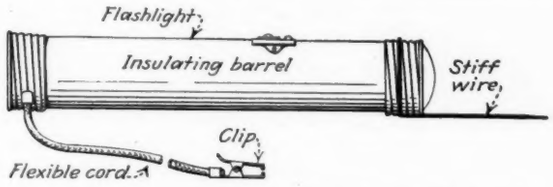
* * * *

Using Flashlight for Testing

IN THE article on using a flashlight for testing, by George Ludwig, in the May 22 issue, he used a flashlight on which the cap on the front end of the case is not a part of the battery circuit. There are flashlights in which the cap on the front end is part of the battery circuit and with this type the test leads are connected directly to the caps at each end of the case as in the figure. A flashlight rigged up in this way makes an excellent instrument for testing circuits on control panels, switchboards and similar equipment.

A short piece of stiff copper or brass wire is wrapped around the metallic cap on the lamp end of the flashlight, which has an insulating barrel, and soldered with an exploring tip, as shown in the figure. Ten or fifteen feet of flexible insulated cord with a clip on the end is soldered to the bottom cap. The switch on such a flashlight is connected between the lamp and base caps, and by connecting around it through the circuit to be tested, the lamp is lit if the circuit is complete.

Control circuit wiring is often inaccessible for tracing, and sometimes bundled up in cables so that it is nearly impossible to follow a single wire. When a circuit is to be lighted out with the arrangement shown, the clip on the flexible lead is placed on one terminal of the circuit, and the stiff wire on the other. If a light is obtained, the two are directly connected. The low voltage of the battery will not light its lamp through any appreciable resistance, such as most coils or resistance tubes mounted on control panels. It is therefore not necessary to disconnect wires to parallel circuits through



Flashlight arranged for "lighting-out" circuits

instruments, as it might be if a 110-volt lighting circuit were used.

The flashlight may be used in the ordinary manner to look for the desired wire or terminal if it is in a dark place; then the switch is released and the tip touched to the point for the test. Any circuit can be quickly and easily tested, or a direct short circuit or ground located, with no possibility of receiving a shock or damaging the equipment. K. M. WHITE.

Wilkinsburg, Pa.

* * * *

Skill Is Not Dead

I REGARD the brief editorial entitled "Skill Is Not Dead," in the May 8 issue, as an able answer to those present-day critics who bemoan the passing of the good old-fashioned mechanic. The much-lamented natural-born tradesman usually was just that—and always remained so. There existed no incentive for one with his native ability to supplement the product of his hands with the developed co-operation of his head. His all-around performance might be entertaining today, but the big question is whether he would be good enough to stand the gaff of modern speed at any one of his accomplishments.

Remember the old village band that gave concerts in the square on Saturday nights—they were deemed mighty good in their day. Yet a group of modern young men, organizing a dance orchestra today, certainly give more thought to practice and musical perfection than the old village band leader ever did. Their native ability in the old days was again so good they didn't have to practice much. And so it goes, we have learned all along the line to concentrate and speed up. Even in trades where the machine does not enter directly, such as brick laying, house painting, etc., if we consider the volume of a regular day's labor today with what was considered a good day's work in the past, we might honestly wonder how they got away with it.

When it comes to responsibility, an error in the old days usually meant one spoiled piece. Today it is far more serious—one error in a set-up may spoil a whole run of hundreds of pieces. We are becoming specialists without a doubt, but rather than its being a matter of losing skill in the process, I believe we are actually gaining it. True, it is often not a picturesque skill, but it does contribute mightily to modern industrial progress.

Philadelphia, Pa. GEORGE NEIL.

Was Electrolysis the Cause of the Water-Pipe Failure?

THE interesting instance of water-pipe failure cited by George I. Mackenzie in the March 6 issue cannot be solved without a knowledge of additional facts. In attempting to determine the cause of failures from underground structures, there are usually certain data of value which are overlooked and which are destroyed at the time of making repairs.

If the water-pipe failure was due to a physical condition, it would be due to a sudden rise of pressure in the pipe, a sudden compression from the outside, a longitudinal tension, or crystallization of the lead due to vibration.

It is stated that the pipe was "completely broken off." A close examination of the fracture with the naked eye should show a good many things, including the cause of the rupture, whether coming from within or without the pipe and whether it was assisted by gradual weakening in the pipe itself due to chemical corrosion, electrolysis, crystallization from vibration, etc. In fact, an examination with the naked eye or even with the microscope would go a long way toward finding the actual cause.

It is my opinion that electrolysis was out of the question. Electrolysis never results in a clear break. The weakening of the pipe occurs over considerable surface until the pipe is too weak to withstand the pressure of the water; then a leak, small at first, occurs.

Seepage, in conjunction with corrosive liquids from refrigerating and chemical plants, sewage and other sources, may frequently cause corrosion and, eventually, leaks. These result in a gradual eating away of the metal until the pipe ruptures under the pressure. Chemical corrosion would never, however, cause a pipe to be "completely broken off."

There is a possibility that the water pipe froze and cracked. This would result in "the water pouring in from the direction of the street." It would not, however, explain how it was that the pipe was "completely broken off." Did the accident occur during cold weather? Is the pipe exposed to cold? Was the water moving, or would it freeze easily?

With the water pressures commonly used in cities, a fairly small hole may exist a long time before it increases much in size. A plumber groping around in water-soaked earth may easily dig into a pipe and so cut it off. Only an examination of the surrounding soil could show if there had been a sudden application of load above (as the passing of an exceptionally heavy truck) which might have sheared the pipe due to the immediate proximity of a sharp stone or similar obstacle.

In attempting to solve problems of this kind, it is important to know something about the condition of the break, the shape of the pipe at the break and on both sides of the break; the appearance of the fracture, whether it is crystallized, bright, jagged or shows any sign of a sharp instrument or the effect of high temperature, as from an arc. The ground should be studied with a view to determining the possibility of any chemical action or anything unusual. The surface of the ground and the possibility of heavy loads, vibration or "settling" should be taken into consideration. Whether the pipe at the fracture was completely inclosed in earth, whether it was accessible for anyone seeking to cause damage or susceptible to longitudinal stresses, are other factors to be borne in mind. The only connection electricity could have in the present case, it would seem, is a possibility of an arc through a short circuit, and this seems most improbable. In any case the pipe would not be "completely broken off" from this cause. The only way of determining this is to examine the fracture.

The solution of the problem lies in knowing the condition of the pipe a foot or more each side of the rupture, the characteristics and shape of the fracture and the possibility of the effect of the aforementioned condition. From the facts, suspicion points to the plumber as being to blame for the pipe being completely broken off, while the initial leak remains a mystery, the consequence obliterating the cause.

C. G. CROWLEY.

Chicago, Ill.

ANSWERS to "What Do You Know"

The questions are on page 1013

Ans. 1—If a tube hole is too large to hold the tube without excessive rolling, a copper thimble, or ferrule, is slipped around the tube end before the tube is rolled, or expanded.

Ans. 2—No pump will handle water with a lift of 35 ft. The theoretical maximum lift is approximately 34 ft., depending on the atmospheric pressure, but few pumps will lift over 24 ft.

Ans. 3—A draft of 2.3 in. means that the pressure above the fire is 2.3 in. of water less than in the ashpit.

Ans. 4—Gasoline vaporizes at the ordinary atmospheric pressures and temperatures. If the suction pressure is reduced materially, the gasoline will vaporize, gas-binding the pump.

Ans. 5—The Walschaert gear is used on many locomotives. Its chief advantage is that it gives an almost constant lead at all cutoffs.

Ans. 6—A low-pressure turbine operates on low-pressure steam only. It should be installed only where there is an ample supply of steam at atmospheric pressure or a few pounds to carry the load at all times. A mixed-pressure turbine operates on both low-pressure and high-pressure steam. When the supply of low-pressure steam falls off, the turbine automatically admits high-pressure steam to carry the load.

Ans. 7—In dual drive the exciter pump, or whatever it may be, is so arranged that it can be operated completely by a steam turbine or completely by a motor. In a duplex drive both the motor and turbine may be used at the same time and the load divided between the two prime movers.

Ans. 8—Some of the steam must be allowed to pass on through the low-pressure stages so as to keep them cool.

Ans. 9—The average air consumption is 0.25 cu.ft. per minute.

Ans. 10—At about 1.200. Chemically pure water, H_2O is an insulator. Likewise, chemically pure concentrated sulphuric acid, H_2SO_4. Mixing the two together produces a solution that is an electrical conductor, which at a specific gravity of about 1.200 has its minimum resistance. This is one of the reasons for use of specific gravity between 1.220 and 1.280 for storage-battery electrolytes.

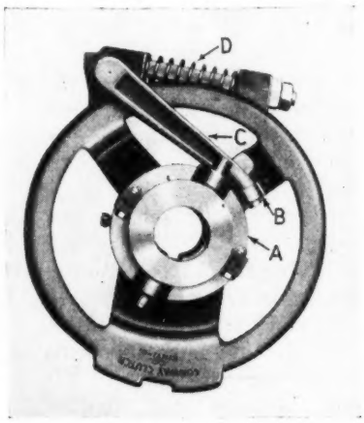
PLANT EQUIPMENT NEWS

New and improved equipment in power and industrial plant fields, and new applications of existing equipment

Conway Contracting Band Clutch

THE illustration shows the new contracting band clutch recently brought out by the Conway Clutch Company, 1956 West Sixth St., Cincinnati, Ohio.

The clutch is operated by a shifter



Contracting band clutch

yoke which slides a cone member *A* under the roller *B* on the end of the operating lever *C*. When the cone slides under this lever, contracting the friction band, the high leverage ratio assures the application of ample driving power. When the operating lever is thrown in the reverse direction to release the clutch, the spring *D* assists in drawing friction band out of its segment. The clutch is of all-steel construction and the shifter cone is made of hardened steel. A finished surface is provided on the clutch carrier, on which the lever *C* slides.

Of special importance is the ease with which the friction lining may be replaced. To do this it is not necessary to remove the clutch from the shaft, but by simply removing two screws and shoving the pulley, or other member with which the clutch is used, along the shaft a distance slightly more than the width of the friction band, the new lining is readily replaced.

Some of the claims made for this new clutch by the manufacturer are easy engagement, instant release, guide free idling and exceptionally high-powered capability.

New Guide Clamp Stops Breakage of Conductors

A FREQUENT cause of trouble in outdoor station installations is the fact that the conductors often break as the result of crystallization close to the point where they are rigidly held to the connection members of oil circuit breakers, transformers and disconnecting switches. This danger has been eliminated by a guide clamp recently placed on the market by the General Electric Company.

The new guide clamp, as shown in the figures, consists of a cast arm four to six inches long, provided with holes at each extremity for bolting to the

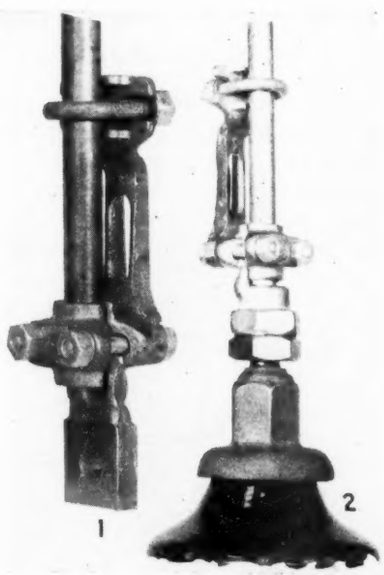


Fig. 1—Guide-clamp terminal applied to disconnect switch. Fig. 2—Guide-clamp terminal for oil circuit breakers or transformer studs

conductor and terminal. Its function is to distribute the point of flexure over an appreciable length of conductor and thus to relieve the metal adjacent to the connecting stud of the full effect of vibration and swinging which often result in crystallization and ultimate failure.

The clamp is made in a variety of sizes suitable for attachment to conductors in sizes from No. 2 up to $2\frac{1}{2}$-in. iron-pipe size copper tubing, and can be applied to the terminals of standard outdoor station apparatus, and to tubular conductor connector fittings in outdoor bus work. It is made of copper alloy and is provided with hot-dipped galvanized hardware. For application to existing installations extra-long holding bolts are supplied.

Binks Spray Cooling Tower

THE Binks Spray Equipment Company, 3114 Carroll Ave., Chicago, has recently brought out the cooling tower illustrated, in types A and B for capacities up to 25 and 100 gallons per minute respectively. The new tower is especially adaptable for small refrigerating plants having capacities from one to twenty tons of refrigeration and for cooling jacket water for Diesel engines, compressors and other apparatus where the capacity involved does not exceed 100 gallons per minute.

Fig. 1—Tower in course of construction

In the new tower a combination of the spray system and atmospheric cooling-tower principles are employed. An inverted spray head with seven nozzles, placed at the top of the tower, directs the water downward against the louvers, a pressure of 7 to 10 lb. being used at the nozzles.

All metal beams, cross-members and tierods used in the construction of the tower are of extra-heavy galvanized steel and all woodwork is of cypress. The four corner posts with cross-members and tierods comprise the skeleton frame into which the louvers are dropped into position. When all louvers are in place, the tierods are tightened and the structure made rigid.

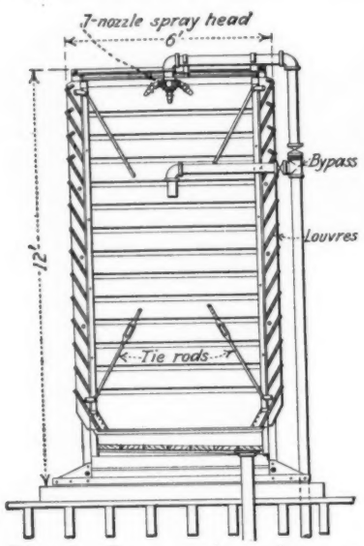


Fig. 2—Cross-section of tower

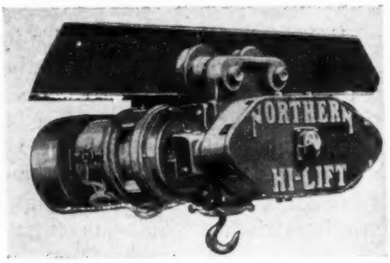
It is pointed out by the manufacturer, that where a larger capacity is required than obtainable with the type C, the towers are installed in series and added to as requirements demand.

Northern "Hi-Lift" Trolley Hoist

A NEW "Hi-Lift" hoist, especially adapted to use in plants with low ceilings, has been introduced by the Northern Engineering Works, Detroit, Mich.

The hoist is equipped with an I-beam trolley and is provided with two brakes; a motor check brake attached to the end of the hoist motor armature shaft, and a mechanical load brake in the hoisting gear train. These are positive-type, friction-disk ratchet brakes of the same construction as the mechanical brake that is now used on the other hoist and crane trolleys manufactured by this company.

Another important feature is the one-piece unit frame casting. This construction, it is claimed, keeps the two sides in positive alignment. A flexible coupling is used for the hoist motors and compensates for any slight misalignment between the motor and the hoist drive. The load hook can be pulled up to within 14 in. of the beam, and two stops are provided—one to prevent the load hook from going up too high and the other to prevent completely unwinding the rope and starting it on the wrong side of the drum. The gear covers are split horizontally and can readily be



Low-head trolley hoist

lifted up, permitting inspection of the gearing or removal of any part without distributing other parts.

Water-Level Indications Transmitted Long Distances

ACCURATE data on water levels are an important part of the information required to operate hydro-electric plants, water works and other projects where water heights are involved. For such work there has recently been developed by Carl H. Au, mechanical engineer, Washington, D. C., an improved type of water-level recorder and indicator, which uses selsyn motors for giving long-distance indications. The equipment is manufactured by Julien P. Friez & Sons, Baltimore, Md.

One of these indicators is shown in Fig. 1 and the recorder in Fig. 2. The water level is obtained by the height of the float *W*, the position of which is transmitted to the drum *D*. As the float rises and falls with the water level, drum *D* is rotated and turns the rotor of the selsyn motor *M*. The selsyn has a stator with a three-phase winding and a rotor with a single-phase winding. These windings are connected in parallel with the windings of the selsyn in the distance indicator, shown in the upper part of Fig. 1. The rotors of the selsyns are connected to a source of 60-cycle single-phase current. As the rotor of the selsyn on the transmitter is moved by the rise and fall of the float, the rotor of the receiving indicator turns to a corresponding position.

The indicator has two hands, or pointers; the outer circle of

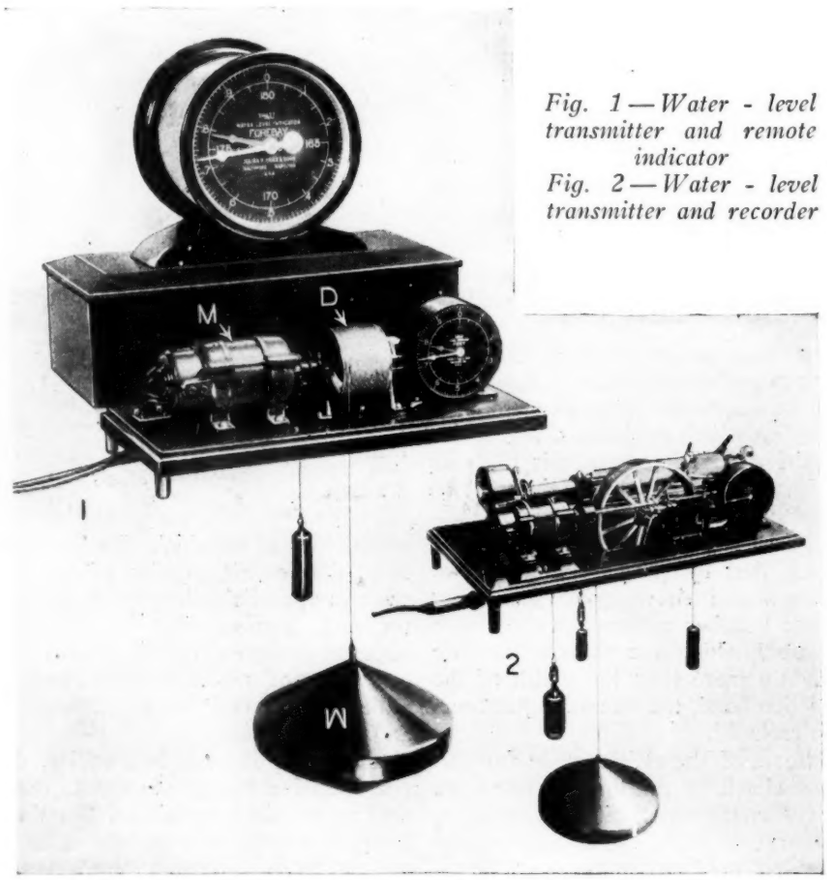


Fig. 1—Water-level transmitter and remote indicator
Fig. 2—Water-level transmitter and recorder

graduations completes one foot of stage, with decimal graduations to hundredths of a foot. The inner circle of graduations shows the integrations of the water level change in feet and is numbered for the range of elevation of each individual installation.

The transmitter, with its indicator or recorder, is located at the site where the water level is to be measured and the indicator in the power house or whatever place it is desired to have knowledge of the water level. The use of selsyn motors is not new, although their successful adoption to water-stage recorders is a recent development, and makes possible the transmitting of water-level indications several miles with a fair degree of accuracy.

The recorder, which is shown in Fig. 2, is generally located at the site where the water level is taken. It is adapted to be furnished with various convenient ratios of stage and for various speeds of paper travel. Provision is made for easy removal of short-period records. Either glass pens with ink reservoirs or pencils are standard. The recorder is also equipped with its own indicating dial for determining the water's height independent of the chart.

Pennsylvania Self-Contained Single-Stage Air Compressor

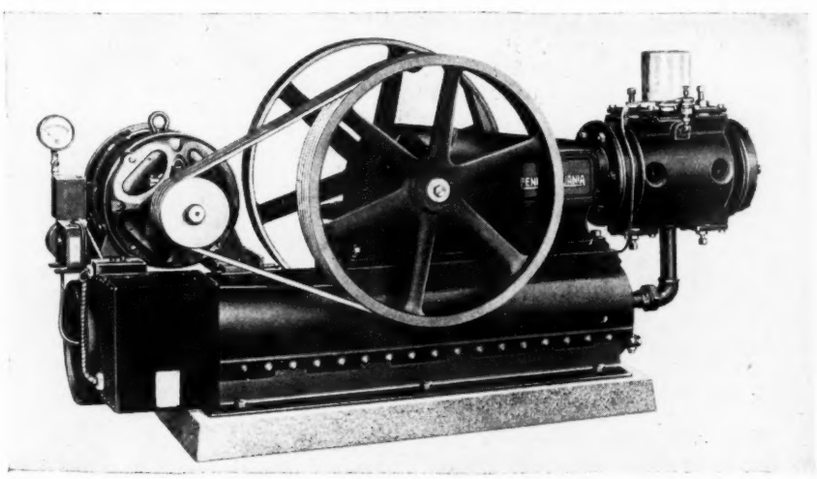
A COMPLETELY self-contained air compressor unit in which the compressor and driving motor with starter and controls are mounted on the top of the receiver, has been brought out recently by the Pennsylvania Pump & Compressor Company, Easton, Pa.

The compressor is of the single-stage, double-acting type operating at a speed of 400 r.p.m. and having a piston displacement of 65 cu.ft. free air per minute. It is equipped with multiple-belt drive from a 10-hp. motor, air filter and automatic start and stop control with a pressure range between 85 and 125 pounds.

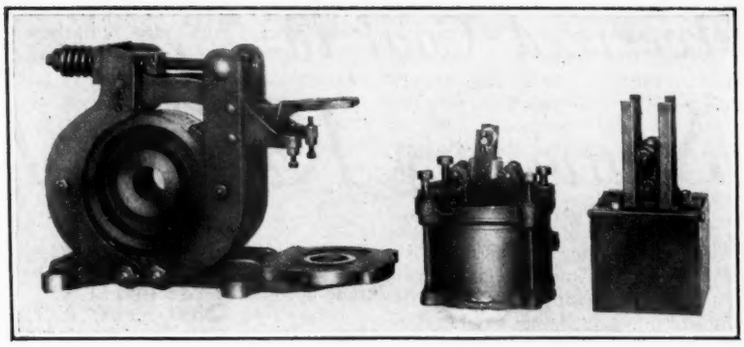
The receiver is fitted with an angle along each side to take the foundation bolts, the angles together with the receiver serving as a bedplate for the complete unit. Over-all dimensions of the unit are: Length, 6 ft. 6 in.; width, 2 ft. 4 in.; and the weight is 1,380 pounds.

For installations where a regular water supply is not available for the compressor cooling, the unit can be furnished with a hopper cooling tank. Units are also built with this construction in the two-stage type for pressures from 125 to 250 lb.

The new unit is equipped with the standard Pennsylvania air-cushioned valves and all working parts, including the air cylinder, are automatically lubricated.



Compressor with motor drive and receiver form a compact unit



Solenoid brake with D.-C. and A.-C. solenoids demounted

G. E. Solenoid Brakes with Spring Setting Device

SIMPLIFICATION is the feature of a new line of solenoid brakes recently introduced by the General Electric Company, Schenectady, N. Y. The new line includes brakes for operation on alternating and direct current and involves in its construction the use of a spring setting device.

The brakes are especially designed for severe service in connection with mill, crane and hoist motors. The braking mechanism is held in the off position by a coil and plunger; when power is applied to the motor, the coil is energized and the brake is released, and when the power is shut off, the spring setting device forces the mechanism into the closed or braking position.

Both alternating- and direct-current brakes use the same brake mechanism and frame, the solenoids being interchangeable. Further flexibility is obtained by making the floor-mounted brake the basic unit of the line. By adding a mounting bracket, it becomes a motor mounted brake. The brake, being spring set, can be mounted in any position.

Exceptionally small-diameter brake wheels are used, minimizing flywheel effect. The brake shoes are of cast iron and self-aligning, and compressed woven asbestos lining furnishes the braking surface for the shoes.

The brake yokes of plate steel are pivoted below the wheel near the center line and cover the rim on both sides of the wheel, so that it cannot come off the shaft accidentally.

The solenoid assembly may be quickly removed from the brake mechanism by taking out four bolts, lever or brake adjustments remaining undisturbed. The coil only may be removed, if desired, from the larger sizes.

Pulverized Coal in

Stationary Railway Power Plants

THOUGH among the first, if not *the* first, of American industries in pioneering commercial scale installations of pulverized-fuel-fired boilers more than a decade ago, the railroads[1] found their early experiences costly and in some cases disastrous. Though the method's patent and research record had extended back continuously more than 100 years[2] and thus these roads could not have been accused of lack of cautiousness and conservatism, yet the state of the art had simply not progressed sufficiently at that time to make commercial success possible.

Feeders, burners and transport systems were crude and ineffective. Maintenance costs were prohibitive. Equipment and installation first costs ranged two to three times present-day costs, hence fixed charges more than ate up savings, over former firing methods. Last, but not least, attention was divided between two problems rather than concentrated on one, for the basic purpose of most of these early efforts was an eventual solution of locomotive firing with pulverized fuel. This problem still remains unsolved though recent developments make success more probable.

These costly experiences determined the steam[3] road's attitude for the past ten to twelve years of "letting the other fellow do the experimenting." So well, however, has "the other fellow" done his job that the growth and success of powdered coal has been phenomenal.

Steam-railroad stationary power-plant installations known to this committee are as follows:

Canadian National Railway, having two 10,150-sq.ft. B. & W. boilers equipped with Aero pulverizers.

Erie Railroad—Jersey City, N. J. (see Fig. 1). Ten 2,500-sq.ft. boilers equipped with Aero pulverizers.

Duluth, Missabe & Northern R.R., Proctor, Minn. (see Fig. 2). Two 2,500-sq.ft. Stirling boilers with two "Unipulvo" pulverizers.

Kansas City Southern Railway, Pittsburg, Kan. (see Fig. 3). One 3,750-sq.ft. Heine boiler equipped with Aero pulverizer and four 2,500-sq.ft. Heine boilers equipped with Aero pulverizer.

New York Central R.R. Co., Avis, N. Y. (see Fig. 4). Three 5,010-sq.ft. Erie City three drum boilers.

New York, New Haven & Hartford R.R., Cos Cob, Conn. One Combustion Engineering Corp. "Steam Generator" with four pulverizers (see Fig. 5).

New York, New Haven & Hartford R.R., Boston, Mass. Four 5,010-sq.ft. Stirling boilers with four pulverizers.

Standard Steel Car Co., Hammond, Ind. Eight 2,500-sq.ft. B. & W. boilers with Aero pulverizers.

Toronto and Northern Ontario R.R., North Bay, Ontario (see Fig. 6). Two 2,500-sq.ft. B. & W. boilers with two Kennedy Van Saun airswept tube mills.

There are also an approximately equal number of electric railway installations.

The total number of applications in all industries will exceed one thousand plants and more than two thousand individual boilers.

Advantages and disadvantages, operating and maintenance costs, mill and burner types, as well as difficulties and their avoidance are frankly discussed in the report of the subcommittee on "Coal Fired Plants"[4] of the International Railway Fuel Association. The first two sections of the report are here abstracted; the second and third sections will follow in subsequent issues.

Powdered Coal No Panacea

In the present enthusiasm for this method lies its great danger. Powdered coal is by no means a panacea for all the evils of the boiler room. In the hands of inexperienced consulting engineers, designers, manufacturers or operators the method is even yet, all too frequently, resulting in costly failures or half successes. Relatively few engineers have as yet had extensive experience with powdered coal in small units. In this field, especially, a knowledge of "what not to do," gained through broad experience with previous jobs, is much more important than a knowledge of "what to do."

There is a dearth of dependable data concerning installations on boilers of from 100 to 600 rated horsepower. In these the railroads are principally interested.

Many small boiler operators have been led to believe that they can secure efficiencies similar to those of the larger plants, and this infrequently is the case. Though few, if any, fundamental reasons exist why the smaller job cannot show quite as good boiler efficiency, the economics of these smaller operations usually condemn them to poorer load factors, greater banking and low load losses, less waste-heat recovery equipment and minimized first costs to keep down fixed charges. It should be pointed out, however, at this point that from the standpoint of over-all station (coal to electricity) efficiency, *plants that have use for low-pressure steam for heating or process work, can nearly always produce steam cheaper than the most efficient central station.*

The world's record central station thermal efficiency to date on a straight steam cycle is 27 per cent. This corresponds to a net kilowatt-hour on 12,462 B.t.u. with a boiler efficiency of 87½ per cent, a coal rate of 0.89 and a water rate of 7.85 lb. per kw.-hr. However, in the process steam using industrial plants as against a loss in boiler and turbine mechanical efficiency of, say, 4,000 of this 12,462 B.t.u., there is a gain from low head heat recovered from the turbine exhaust of at least 8,000 B.t.u. This makes a net of 4,000 B.t.u. per kw.-hr. in favor of the process steam-using plant. In certain cases cyclic efficiencies as high as 60 per cent (equivalent to 4,250 B.t.u. per kw.-hr.) have been attained under such conditions. In Europe this is being recognized to such extent that there are a large number of process-steam-using industrial plants actually selling current at an attractive profit to the electric light companies.

Among such smaller industrial plant jobs, the variously designated "central," "storage," "bin and feeder" or "indirect firing" system seldom finds a place. The field seems exclusively that of the "unit" or "direct-firing" system.

Unit mill proponents, on the other hand, are claiming a general trend toward their method in all sizes of installations. Upon the merit of these controversies the committee does not presume to dwell, but for railroad power plant application, the instances where the central system will be justified are believed to be so few that this discussion will be confined to the application of the unit system to boiler units of from 1,000 to 6,000 sq.ft. of heating surface.

Advantages of Pulverized Coal

1. Some of the troubles due to poor coal are overcome:

(a) Where sized coal is required for existing equipment.

(b) Where cheaper slack is obtainable.

[1] M. K. & T., Santa Fe, N. Y. C., American Locomotive Works, etc.

[2] *Commercially* the stoker is somewhat over fifty years old, while powdered coal for boilers is less than ten.

[3] Several *electric* railroads especially the Milwaukee Electric Railway & Light Co., contributed notably to the progress of the art during this period.

[4] This subcommittee is made up of Wm. Olson, N. Y. C. chairman, E. F. Allard, C. & N. W., J. C. Brekenfeld, St. L. S. F., H. W. Brooks, cons. engr., C. C. Chase, M. K. T., J. S. Morris, N. Y. C. & St. L. and L. C. Winship, B. & M.

(c) Where cheap available fuels are of such poor quality or undesirable physical state that they are worthless unless pulverized.

(d) In markets offering coals of widely varying characteristics.

(e) In markets frequently offering "distress" coal.

2. Flexibility in operation substantially equal to oil or gas:

(a) Greater ease in maintaining proper fuel-air ratios with varying loads and fuels.

(b) More nearly smokeless operation is possible from the easier furnace control.

(c) Simpler and more effective applications of automatic control.

(d) Less time and fuel are wasted in starting, stopping or banking.

3. More rapid and complete combustion, due to large surface exposure of finely divided particles:

(a) Efficiencies within 3 to 5 per cent of theoretical have repeatedly been demonstrated.

(b) Less excess air required for burning, therefore.

(c) Lower exit gas temperatures and dry gas losses.

(d) Less unburned combustible (1) in ash (2) in unburned CO and gaseous hydrocarbons.

(e) Clinkering losses are prevented.

4. Banking stand-by and low ("valley") load losses are reduced.

5. Higher ratings or more boilers can be carried on existing stacks of given size without addition of mechanical drafting equipment.

6. Operating labor can frequently be saved.

7. Savings in maintenance can in many instances be effected by reason of:

(a) No metal parts exposed to flame.

(b) More uniform temperature conditions throughout furnace.

(c) More equitable distribution of burning fuel throughout furnace.

Discussion of Advantages

Many misinterpretations result from the statement that any coal can be burned in pulverized form, though much has been done to prove just this. Anthracite, river anthracite, culm, semi-anthracite, semi-bituminous, bituminous, Iowa coal, sub-bituminous, lignite, "bug dust," asphalt, petroleum coke, high- and low-temperature coke and braize have been burned in pulverized form both alone and in combination with oil, gas, shavings, sawdust, bagasse and even with solid fuels.

Note especially, however, that all of these have not been burned in the same furnace nor in the same design of plant.

It is true, however, that with most pulverizers the form factor of coal means little if anything in its use in pulverized form. In fact, fines which usually sell cheapest (if not too high in ash and sulphur) are often preferable to sized coal, for the power consumption per ton of coal ground may actually run a few per cent less. This is not true with every type of pulverizer, however. At least two cases are known with a certain mill on Illinois coal of high inherent moisture content where wet screenings quickly plugged the mill, necessitating the use of the coarser sizes when operating with coals from this field.

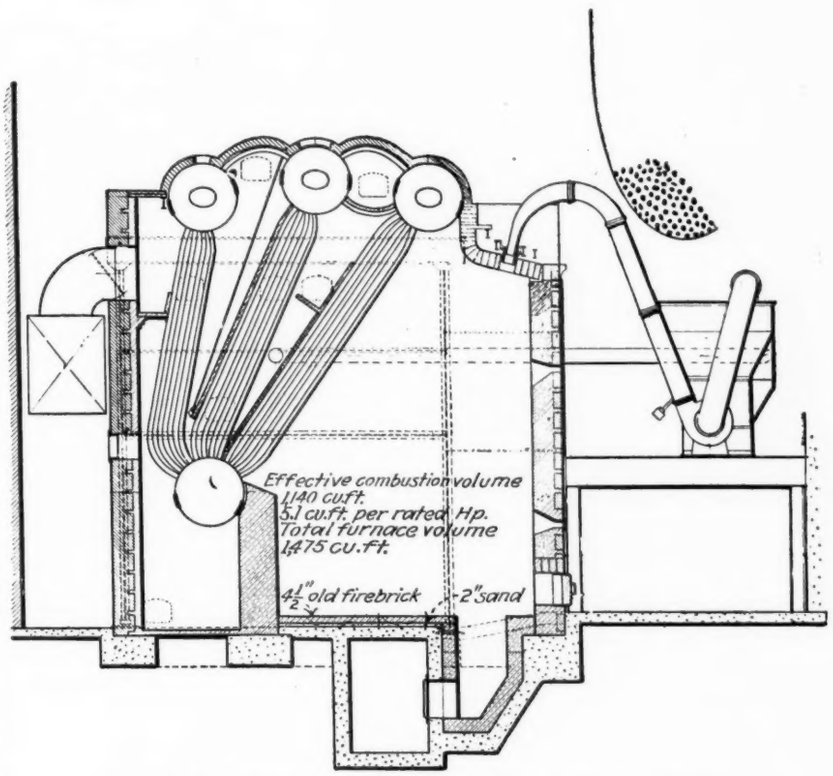


Fig. 2—Missabe & Northern R.R. plant at Proctor, Minn.

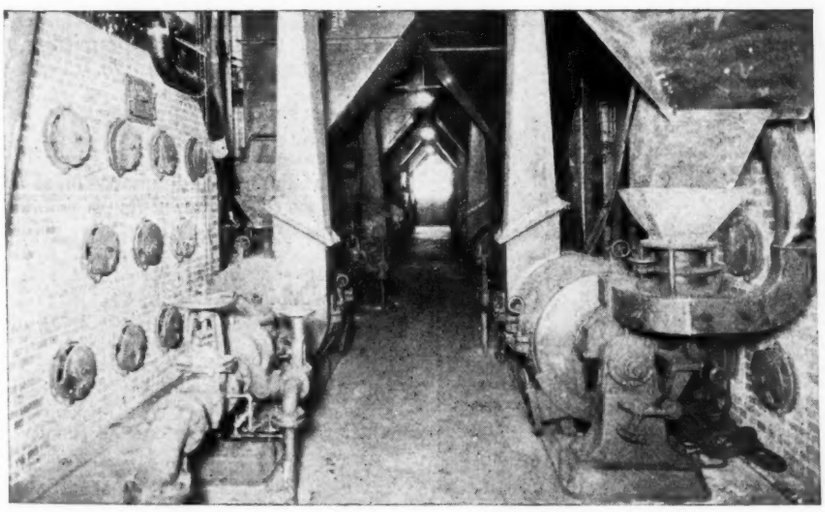
Savings favoring slack or screenings over sized coal average $1.15, $1.80 and $1.65 per ton respectively. Of course, the B.t.u. content of the slack or screenings may run lower than the mine-runs or sized coal, but the increased efficiency of powdered coal over hand firing or over the cheaper stoker installations frequently more than cancels this difference. This comparison, however, is one that must be carefully checked in each instance.

Still another similar saving sometimes becomes possible when a poor local coal unburnable efficiently with hand or stoker firing, can, when used in pulverized form, replace a more expensive imported coal.

It has been pointed out that not all solid fuels obtainable should be expected to burn equally economically in powdered form in a given design of furnace or system. Oftentimes, however, if sufficient money is spent originally to permit use of the worst coal obtainable, the better grades can be used when economic conditions dictate. If this is not done, the converse is seldom true.

This, however, can be said of pulverized fuel which cannot be said of hand or stoker firing—that in general the

Fig. 1—Ten boilers equipped with unit pulverizers at Erie Railroad plant Jersey City, N. J.



majority of coals from a given district can be used with substantially equal satisfaction in an installation properly designed for normal variations of coals in that district. However, a system or furnace designed for low volatile coals should not be expected to give equal results with high volatile (unless originally designed for both, and even then equal satisfaction cannot always be guaranteed). Again, a system or furnace designed for high-fusion ash will never give equal results with low-fusion ash.

Flexibility of Powdered Coal

The Prime Movers Committee N.E.L.A. (Great Lakes District) report of 1926-27, page 16, well expresses the situation in the following quotation.

> It is, of course, useless to make a pulverizer more flexible than the burner it serves and conversely, it is useless to design a highly flexible burner to use with a pulverizer that has a small range of regulation. Most unit pulverizers are designed to control their air supply by throttling the air inlets to the pulverizer. This method of air control builds up a high negative pressure at the feeder and causes the coal to be pulled into the pulverizer in an erratic manner, with the results that when low ratings are attempted the combustion conditions are so irregular as to be entirely unsatisfactory. . . . In fairness to the pulverizers now on the market it should be stated that most of them have flexibility materially in excess of most of the burners now in use.

It is more conservative judgment to design preferably on the basis of a maximum four to one range or less and in the present state of the art never to count on more than five or six to one. Taking into consideration that steam is usually kept up by the heat from the walls of powdered-fuel furnaces during banking periods, these ranges are more than ample for all usual requirements.

In the greater ease and simplicity of maintaining proper fuel-air ratios under varying conditions undoubtedly lies the principal reason why powdered-coal operating efficiencies lie so much closer to test efficiencies than with stokers. With reasonably good (say 50 per cent) load factors by day, week or month, and not too frequent or lengthy banking periods, differences as small as 2 per cent have been demonstrated. Differences with stokers of as much as 5 to 10 per cent had not been uncommon under similar conditions.

Full automatic control appears not to have been attempted with unit pulverizers, but quite adequate semi-automatic control can be purchased for from a few hundred dollars per boiler up, depending on the system employed, size, load variation and the extent of the automatic control economically justifiable. In such installations the few remaining non-automatic adjustments can most easily be handled by the fireman who in powdered-coal plants generally has little to do. There are few if any cases where automatic control of at least the breeching damper and the feed water cannot be justified.

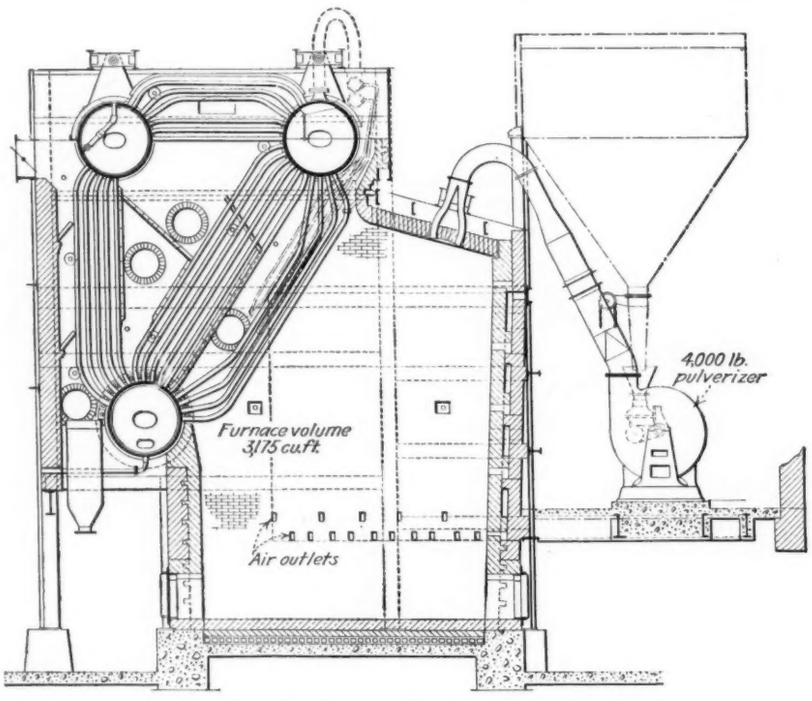


Fig. 4—New York Central R.R. plant at Avis, N. Y.

Low or "valley" load losses are also reduced for the heat-storage capacity of the walls coupled with the ease of control and the very small amount of fuel in the furnace at any one time, all conspire to make possible an exceedingly close correspondence of heat generated and heat utilized.

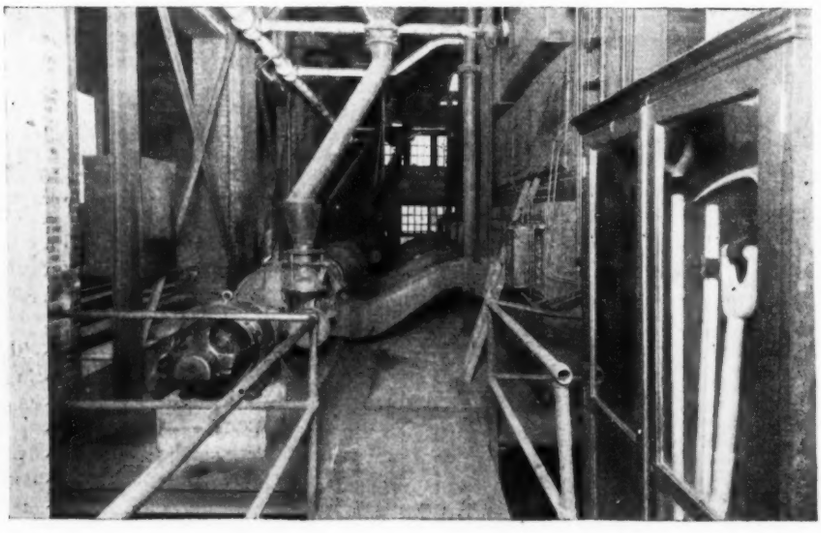
It has been argued that this greater heat-storage capacity may be a detriment to weekly or monthly operating results on account of more coal being burned to heat the walls up from cold. This, however, is not true for when taking a boiler off for repair, coal is usually cut off sometimes before the boiler is taken off the line, thus permitting regaining the major portion of this stored heat.

In general, assuming proper design, the loss due to unburned combustible should average from 1 to 3 per cent, while radiation and unaccounted for should average from 2 to 4 per cent. With heat releases and the sizes of boilers considered in this report, a conservative combined figure for the foregoing would be as follows:

	Rebuilt Boiler Settings	New Boiler Settings
Solid walls	6 per cent	5 per cent
Air cooled walls	5 per cent	4 per cent
Water walls	4 per cent	3 per cent

While it is dangerous to generalize, it will usually be found that at about

Fig. 3—Five boilers fired with pulverized coal at Kansas City Southern Ry. plant, Pittsburg, Kan.



175 per cent of rating, the average 1,000- to 6,000-sq.ft. boiler without air preheater or economizer on Pittsburgh coal will approximate around 80 per cent over-all test efficiency. With average waste heat recovery equipment, this figure will increase to 82 to 84 per cent. These figures may run one per cent higher for water-wall jobs. With Eastern coals these averages may run 1 or 2 per cent higher. With central district coals, like Illinois or Indiana, the figures may run 1 or 2 per cent lower. On very large boilers with large and expensive waste-heat recovery apparatus, over-all efficiencies of over 90 per cent and monthly operating efficiencies around 88 per cent constitute approximate present-day records. (Note: Excepting the last figure, all efficiencies quoted are *code test efficiencies* and should be discounted by a few per cent, depending on conditions for monthly operation.)

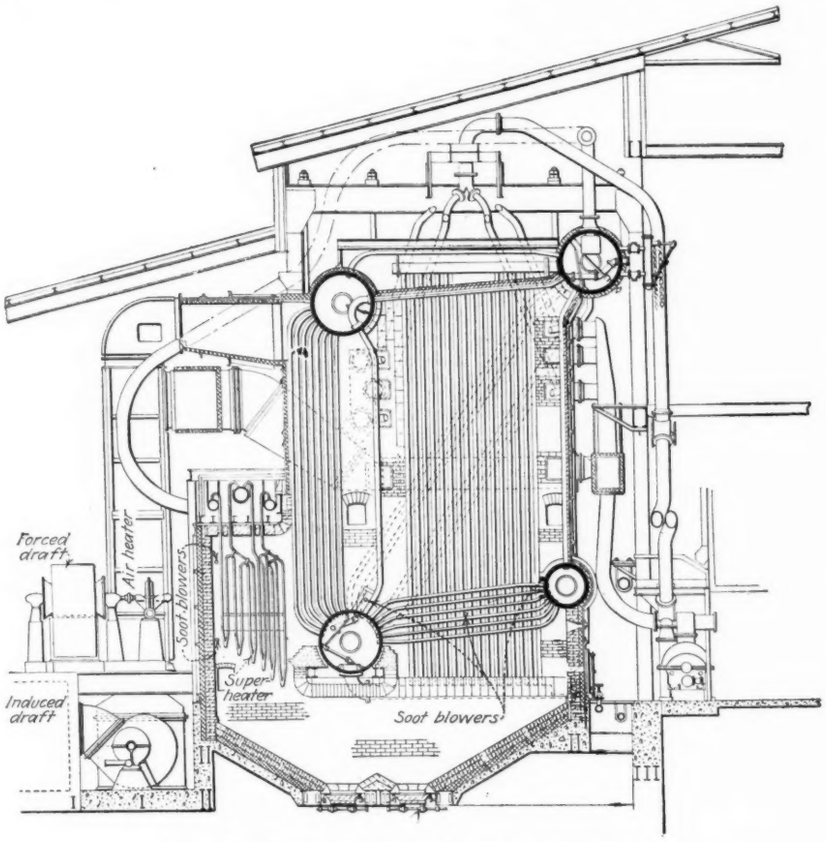


Fig. 5—"Steam Generator" installed at Cos Cob

Excess Air

Fifteen to twenty-five per cent lower excess air is commercially practicable with pulverized coal than with stokers, while with intermittent furnace openings of hand firing the difference is naturally still greater. This difference alone will account for a difference in over-all efficiency under average conditions of 3 to 4 per cent in dry gas loss. This is particularly true when it is recalled that in general the lower the excess air, the lower the exit-gas temperature, while the loss is the product of both gas volume and temperature difference.

Although an unburned combustible loss on test of 1 to 3 per cent is suggested as conservative, this does not necessarily mean this much coal is actually wasted in operation. Losses in unburned carbon monoxide, methane and higher hydrocarbons are inexcusable in a properly designed and operated powdered-coal furnace. The indicated loss of 1 to 3 per cent on test therefore consists almost entirely of coked carbon particles carried through the boiler unburned. Most of these drop out in the dust pockets beneath the rear passes or in the waste-heat recovery equipment (economizer or air preheater). With an air or steam jet these accumulations can be blown into the rear of the furnace and reburned.

Clinkering Losses

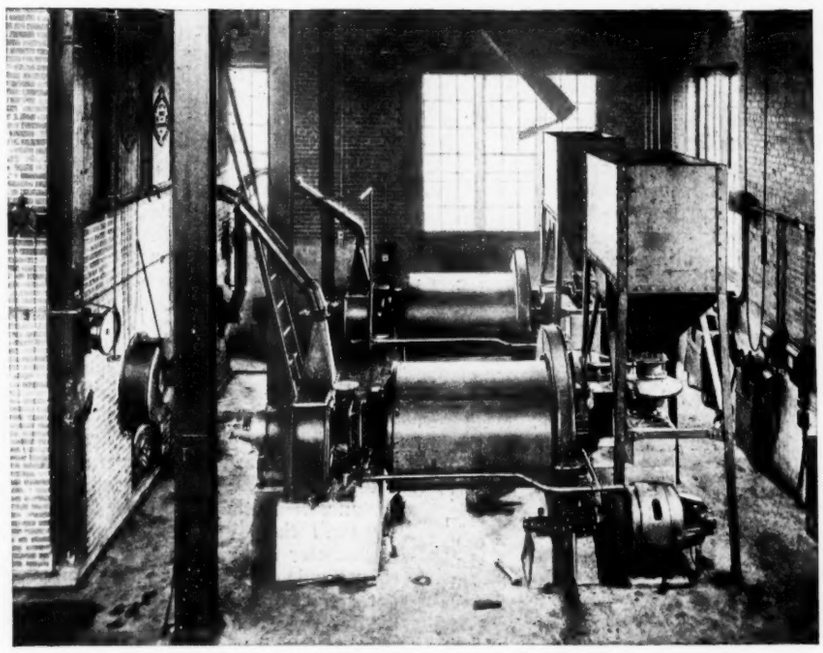
Losses due to clinkering of fused coal ash on grates, both in unburned fuel and maintenance of both clinker line and grate can be largely, if not entirely, avoided in a pulverized-fuel system properly applied. Similarly, the intermittent admission of excess air and consequent emission of smoke when necessary to open furnace doors and break up clinker is avoided. Clinker has no chance to throw excessive strain upon and sometimes rupture moving parts within the furnace. Though slag erosion can and often does take place in improperly designed powdered-coal furnaces where flame is permitted to impinge on the walls, this is preventable and unnecessary.

Stacks for Powdered Coal

As the resistance of a fuel bed does not have to be overcome, the draft requirements of a powdered-coal furnace are considerably less than for natural-draft grates. Thus higher ratings on the same boilers, or more boilers can usually be carried on an existing stack without additional draft equipment.

As a basis for preliminary "rule of thumb" consideration only (and subject to further detailed calculation) it may

Fig. 6—Air-swept mills at North Bay plant of Toronto & Northern Ontario R.R.



be said that there are few cases where maximum ratings of 175 per cent or less are being run on natural-draft grate-fired boilers, that the total developed capacity cannot be increased by at least 30 per cent with the same draft. Another handy rule of thumb to bear in mind is that on the average, powdered-coal stacks require little if any more area than those for oil firing, and for oil burning the requirements are only from 50 to 60 per cent of the area required for coal, according to Kent's tables.

Operating Labor

Often considerable labor can be saved in the small plant when powdered coal is properly applied. Assuming average operating conditions and coal, the availability of reasonable automatic control, coal and ash handling equipment with boilers, pulverizers and control located conveniently, the committee believes one fireman and one water tender per shift can conservatively be expected to handle about six boilers of the sizes comprehended in this report, substantially in accordance with the following table based on three eight-hour shifts.

Number of boilers in boiler room	3	6	9	12
Pulverizer operators.	3	3	6	6
Water Tenders	0	3	3	6
Ash men—(boilers up to 8,000 sq.ft.)	1*	1	2	3
Ash men — (boilers. above 8,000 sq.ft.)	1	2	3	4

Dependent on conditions, an additional ash man (for six boilers) part shift once a day may also be required.

Maintenance

To determine the comparative figure on pulverizers, manufacturers were asked to state mill maintenance in cents per ton of coal ground with the following coals: Pocahontas, Pittsburgh, Illinois, sub-bituminous and lignite. It was recognized that approximate averages only could be given, the exact figures with coal from a given mine varying with different sizes of the same make mill, amount of coal pulverized per hour, moisture content, firability and hardness of coal and its abrasive qualities. Two concerns give maximum and minimum limitations only for all coals—one giving 1½ to 5 cents, the other 2½ to 10 cents. One manufacturer's maintenance records to date for all installations averages less than 2 cents per ton and he is willing to guarantee 3 cents with most coals and not over 5 cents for any coal. Another manufacturer, the type of whose mill lends itself especially well to low maintenance, includes in all contracts a five-year maintenance clause guaranteeing all renewals not to exceed 2 cents per ton f.o.b. factory. Averages for the more usual types of unit mills follow:

Coal	Maintenance Cost per Ton
Pocahontas or New River	2 to 3 cents
Pittsburgh or equal	3 to 5 cents
Illinois or equal	5 to 8 cents
Sub-bituminous	2 to 5 cents
Lignite	2½ to 3½ cents

By-Products

. . . Just because the sales manager shows that he is selling his pickles as fast as the factory can turn them out, is not enough to bring smiles to the board of directors. The dimples show only when the profit-and-loss sheet has a favorable balance.

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. . . Because certain college deans prove by cold figures that industry is embracing each and every engineering graduate, is not grounds for putting on a night shift of professors or getting out after more raw material. It's natural for a factory executive to want a big shop and for the faculty to desire a large school. The question to be answered is, Where does the profit come in?

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. . . According to a study by T. H. Normile, engineering pays so poorly that good men jump to more profitable lines, and the American Society of Mechanical Engineers is planning to study this subject. Mr. Normile ascribes this condition to the abundance of engineers. The market may absorb them, but look at the selling price!

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. . . What engineering really needs is more Lincolns and fewer Ford schools.

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. . . What would you think of an engineer turning biologist? He did in San Antonio, Texas, according to the story of E. W. Staph. The San Antonio fly is red-blooded, so he delights to settle on the meat trucks unloading at the market's cold-storage valuts. And some object to eating meat after the fly has sat at the first table. Something must be done, so the S.O.S. is sent to the engineer. Like the true researcher, this engineer enters upon a scientific investigation of the fly and his habits.

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. . . A preliminary study shows that the fly, like a withered grandsire, objects to drafts. But when it comes to real quantitative data on the subject, the engineering handbooks fall down badly. Clearly, here is a problem calling for engineering initiative and Mr. Staph and his staff are not found wanting.

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. . . A small blowpipe, similar to the bean shooters of our school days, with a small manometer placed near the exit end, is rigged up by the San Antonio engineer. The operator blows into the tube, gradually reducing the distance from the end of the tube to the fly until the fly "gets," at which the manometer is read. Calculations are then made to determine the pressure per square inch at the point where the fly has been.

. . . The data are then assembled and the decision made that a blower will do the work.

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. . . After the blower operation begins, it is found that the air blasts do not shoo all the flies off the meat. Some persistent ones remain; being of the previous summer's crop, they are seasoned and not inclined to let such a contraption get their well-known goat. But, even though they hang on for dear life, they do not get much enjoyment as far as forage is concerned.

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. . . Why are engineers so retiring? It is difficult to assume that, unlike all other groups of mankind, the engineers are modest. Is it a pose?

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. . . Admittedly, some do overcome their diffidence and the group of listeners may secretly pray for a return of the former state. The irony is that those who could talk best, seldom talk at all.

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. . . A friend of mine remarked several months ago, upon hearing of the death of Charles D. Manly, that he had served on a committee with Mr. Manly for several years without knowing that he had been the assistant of Professor Langley and had been the first American to pilot an airplane. Only a fortunate incident led Mr. Manly into one of the most delightful hours of reminiscences my engineering friend has ever enjoyed.

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. . . Probably no human ever got through life without feeling an urge to write a book. What the subject is to be is usually immaterial.

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. . . Even Kit Carson, the Western scout, who could neither read nor write, felt the urge. As Indian killing was the main theme of his life, he made the volume of brass tacks on his gun-stock—one dead Indian, one brass tack. The tacks symbolized something, which is more than can be said for many engineering books that flood the market.

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. . . If there is a good book on turbines or kinematics, why does someone attempt another unless he treats the subject in a new light? Royalties on engineering books are not great, so the desire to produce one must have the same motive that prompts the boy to scrawl a forbidden word on the schoolhouse fence before he flees—a wish for immortality.

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. . . A book that *is* badly needed is a glossary of engineering terms. At a recent meetirg a discussion arose as to the meaning of "therm." One engineer declared it was the same as the British thermal unit; a second disagreed, but could not state just what it did mean. This term is in general use in English gas works and represents the heat equivalent of 100,000 B.t.u.

Donald McFee.

NEWS OF THE FIELD

The editors will welcome the co-operation of readers in reporting interesting happenings, personal or otherwise

Congress Provides for Federal Operation of Muscle Shoals

An appropriation of ten million dollars authorized for formation of Muscle Shoals Corporation

THE Muscle Shoals resolution providing for the development of the government's property on the Tennessee River in Alabama and the construction of a dam at Cove Creek, was adopted by Congress, May 25, when both the Senate and the House approved the conference report on the measure. The Senate vote was 43 to 34, and that of the House was 211 to 146. It is not known whether the President intends to sign or veto this measure.

The resolution provides for government operation of the power and nitrate plants at Muscle Shoals for the generation, sale and distribution of power, and for the manufacture of fixed nitrates with provisions for the manufacture of fertilizer for experimental purposes only. An appropriation of ten million dollars is authorized to enable the Muscle Shoals Corporation, created by the measure, to carry out the projects outlined. Of this appropriation, it is specified that two million shall be made available for beginning construction of the Cove Creek Dam on the Clinch River in Tennessee during the year 1929.

The bill definitely prescribes to whom and in what proportion surplus power shall be sold. It authorizes the sale of surplus power created at the steam plant and dam, and not used in the plant and for operation of locks and other work, to states, counties, municipalities, corporations, partnerships or individuals. Such contracts as are made for the sale of power shall be for periods not exceeding ten year and in the sale of such power, preference shall be given to states, counties or municipalities for distribution to citizens and customers. It provides that the surplus power generated at Muscle Shoals shall be divided equitably among the states within transmission distance.

The bill also provides that such surplus power as is sold to corporations shall be resold at a price not exceeding an amount fixed as reasonable, just and fair by the Federal Power Commission.

Program of Boiler Inspectors Will Feature Welding

Welding as applied to boilers and other pressure vessels will play a prominent part in the Sixth Annual Meeting of the National Board of Boiler & Pressure Vessel Inspectors to be held at the Hotel Lawrence, Erie, Pa., June 18-21. Welded low-pressure heating boilers will be inspected at the plant of the Sims Company in Erie. The largest pressure vessel in the world will be seen in operation at Orville, Ohio, and a demonstration of the welding of large unfired pressure vessels under procedure control will be given at the plant of Reeves Brothers at Alliance, Ohio.

Other visits will include the plant of the Erie City Iron Works (with a demonstration of pulverized-fuel burning) and the plant of the Union Iron Works.

In addition to addresses by well-known boiler inspectors the following papers will be presented: "Dished heads," by Dr. D. S. Jacobus, chief engineer, Babcock & Wilcox Company; "Reinforcement of openings," by H. Leroy Whitney, The M. W. Kellogg Company; "Alloy Materials for Boiler Shells and Tubes," by J. V. Romer and W. W. Eaton, Babcock & Wilcox Company; "Relationship of the Boiler Manufacturer to The National Board of Boiler and Pressure Vessel Manufacturers," by George W. Bach, vice-president and general manager, Union Iron Works.

Giant Gas Engines Ordered for Illinois Steel Co.

For the South Works of the Illinois Steel Company two of the largest blast-furnace-gas engines ever built are on order. They are to form an addition to an existing plant containing six 48x60-in. gas engines driving 3,600-kw. generators. The new engines will be of the horizontal, twin-tandem, four-stroke-cycle type with gas cylinders of 60-in. diameter and 64-in. stroke, and a speed of 83⅓ r.p.m. The maximum capacity of each engine will be 10,000 b.hp., when operating on blast-furnace gas containing approximately 90 B.t.u. per cu.ft. When operating at this capacity each engine will consume about one million cubic feet of gas per hour. Driving a 7,060-kva., 25-cycle, three-phase generator, the normal rating of each unit will be 6,000 kw., and the maximum rating 6,600 kw. provides for 10 per cent overload. Including a flywheel weighing 100 tons, the total weight of each unit will be 3,800,000 lb. The two units therefore will weigh 3,800 tons and will require 76 fifty-ton cars for transportation.

As in the case of the original installation, the new units are being supplied by the Allis-Chalmers Manufacturing Company, of Milwaukee.

British Chemical Combine Places Record Order for Power Plant

Imperial Chemical Industries, Ltd., the recently formed combine which includes such well-known concerns as Brunner, Mond & Co., United Alkali Co., Nobel Industries, Ltd., and the British Dyestuffs Corporation, and whose products include acids, nitrogen products, explosives, dyestuffs, fertilizers, paints, ammunition, non-ferrous metals and alloys, has just placed with the Metropolitan-Vickers Electrical Co. a record order for a power plant. The contract is for nine turbine-alternator sets, with an aggregate output capacity of 93,000 kw. to form the equipment for a new power station under construction for Synthetic Ammonia & Nitrates, Ltd., at the Billingham Works.

More than half the total steam to be generated will be used for manufacturing process work, having first passed through the high-pressure turbines. In the plant will be installed nine sets of three-phase, 40 cycles, 2,400 r.p.m., 6,300 volt turbine-generators of the following types and capacities: three 12,500-kw., primary sets; three 12,500-kw. condensing sets; and three 6,000-kw. feed-heating sets. Two sets in each group will be operating when the station is on full load, the other set in each group being used for emergency or stand by service.

The primary turbines will be designed for operation by steam at a stop valve pressure of 630 lb. per sq.in. gage, superheated to a total temperature of 833 deg. F., each set exhausting at a pressure of 275 lb. per sq.in. and a temperature of 662 deg. F. The electrical output under these conditions will be about 12,000 kw. for each set, this being the service rating.

The exhaust steam from the primary sets will be led to a set of steam receivers, whence it will be distributed, the greater portion being taken to various parts of the chemical plant for process work, some to the last-stage

feed heaters and the remainder supplying the condensing and feed-heating turbine-alternator sets. As a stand-by and to provide for any sudden increase in the quantity of steam required, a set of reducing valves with desuperheaters will be installed as bypasses to the primary turbines.

The feed heating turbines are designed for operation with superheated steam at a pressure of 260 lb. per sq.in. gage, and exhausting at a pressure a little below atmospheric. The exhaust steam from these turbines will be led partly to the first stage feed heaters and the remainder to the evaporating equipment. Three tapping points will be provided at the turbines from which steam is bled to the second-, third- and fourth-stage feed heaters, the fifth stage being fed directly from the receivers into which the primary turbines exhaust.

The feed-water heaters are to be of the surface type, vertical pattern, and fitted with float-controlled automatic bypasses.

Unique Water Power Plan for Egypt

The prospect of sufficient power to electrify the Egyptian railways, irrigation and drainage works and to provide lighting for the entire Delta of the Nile, is opened up by the report of the Desert Survey Department on the subject of the utilization of a vast depression in the desert between the Siwa Oasis and the Delta.

The discovery of this depression was made by chance during the war, by a British officer employed in reconnaissance work in the desert. The officer, upon his return, reported a depression in the desert of about 130 ft. below sea level, in fact a part of it was as much as 400 feet.

The entire area of the depression amounts to about 4,500,000 acres, equal to one-half the present habitable area of Egypt, or an area about equal to that of the State of New Jersey.

Water From Mediterranean To Be Used

As a result of further study, however, it was decided that the most profitable way of utilization would be to create electrical power by means of an 80-mile conduit from the Mediterranean Sea to Qattara. The water would fall from a height of about 120 ft., and the natural process of evaporation would remove the water as fast as it entered the depression. If the depression were filled to a depth of 150 ft. level, the flow of water would be sufficient to generate energy calculated at 170,000 hp.

Apart from the advantages mentioned, the plan might result possibly in important climatic modifications over a large area of what is at present an entirely waterless desert. The cost of the project is estimated at $75,000,000, and $5,000,000 annually for maintenance, but it would insure a revenue of over $10,000,000 annually.

Westinghouse Electric Reports Sales for Past Year

The annual report of the Westinghouse Electric & Manufacturing Company, which was sent to the stockholders on May 14, shows the sales of the company for the year ending March 31, 1928, to have been, in round numbers, $175,000,000; the net manufacturing profit was $14,000,000; the net income available for dividends was $15,600,000; and the earnings per share of stock (preferred and common) were $6.57, or 13.4 per cent. Dividends were paid during the year on both stocks at the rate of 8 per cent per annum, or $4 per share of $50 par value.

These figures indicate a slight decrease in business as compared with the previous year, when the annual sales totaled $185,500,000, and $6.80 was earned per share.

The balance sheet shows current assets aggregating $122,000,000, which is more than eight times the current liabilities, aggregating fifteen million dollars.

The sum of $3,000,000, representing a federal income tax reserve no longer required, was restored to the surplus; a reserve of $1,800,000 was created for pensions and other possible adjustments; and the account for patents, charters and franchises, previously $4,700,000, was written down to one dollar.

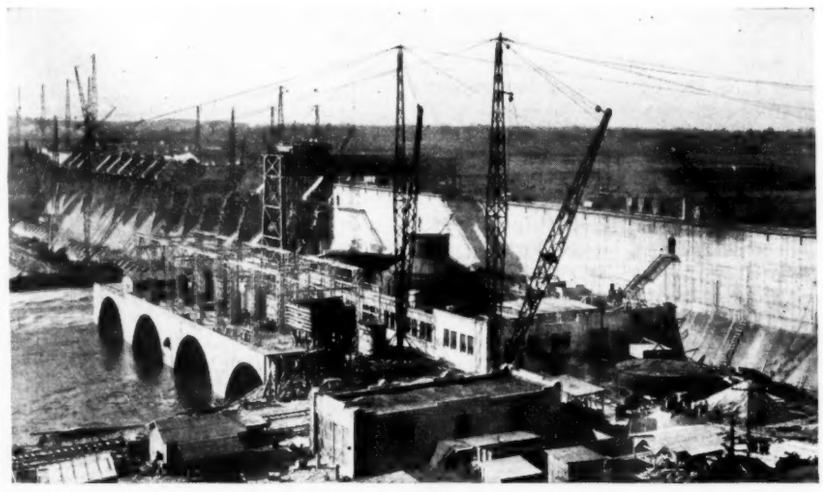
After pointing out that approximately $40,000,000 has been spent in the last six years for new plants and extensions to existing ones, Paul D. Cravath, acting chairman, and E. M. Herr, president, stated: "All plants have been provided with modern facilities and the company is now equipped to take care of business, at present prices, of more than 25 per cent in excess of this year's shipments. In providing these facilities, moves were made that enabled the company to inaugurate advantageous mass production methods."

Franklin Institute Presents Franklin and Potts Medals

On May 16 at the Franklin Institute, Philadelphia, Charles L. Brush was made the recipient of the Franklin medal by the Institute. This latest award is just another expression of esteem in a lengthy list of honors conferred upon Mr. Brush in the course of his scientific career. Among the outstanding examples of recognition are the decoration as Chevalier Legion d'Honneur (France) and the award of the Rumford Medal by the American Academy of Art and Science and the Edison Medal by the American Institute of Electrical Engineers. Mr. Brush is especially noted for the Brush electric-arc light which he brought out in 1878. Later, he contributed many other fundamental inventions in lighting, storage battery and other devices.

At the same time the Howard N. Potts Medal was presented to O. G. Thurlow, vice-president and chief engineer of the Alabama Power Company in recognition of his work in inventing the Thurlow backwater suppressor. This award is the second to be conferred upon Mr. Thurlow in recogntion of his service to the study of science by the invention of the backwater suppressor and other engineering achievements. Last spring the University of Alabama conferred upon him the degree of Doctor of Science because of this accomplishment and because of his practical service in using it in the development of Alabama's resources.

Norwood Hydro-Electric Plant of the Carolina Power & Light Company



This plant has three units, two rated at 22,000 kw. each and one of 18,000 kw. capacity. The upper part of the power house has been omitted and the generators are included in steel casings 40 ft. in diameter and 30 ft. high

Canada Authorizes Lac Seul Water Storage

A bill, sponsored by the Minister of the Interior, to provide for the securing of water storage in Lac Seul, in the upper waters of the English and Winnipeg Rivers, in northern Canada, was passed recently by the Canadian Parliament. The measure gives effect to an agreement made between the Dominion, Ontario and Manitoba governments to increase the dependable flow for power purposes of the English River in Ontario and the Winnipeg River in Manitoba. The direct result of the Lac Seul storage will add 82,000 hp. to the English River and 112,000 hp. to the Winnipeg River.

The agreement represents the consummation of a project which the Department of the Interior, as administrator of Manitoba water powers, has had in view since it began its investigations of the Winnipeg River powers in 1911. The securing of Lac Seul storage is being realized at a time when the increased flow is required by the power installations of the City of Winnipeg and the Manitoba Power Company on the Winnipeg River.

Regulation of the flow through the dam will be placed in the hands of the Lake of the Woods Control Board, and it will be the duty of this board to so regulate the outflow as to secure the most dependable flow and the most advantageous and beneficial use of the water storage for the interests of both the Ontario and the Manitoba water powers.

Securing of storage in Lac Seul marks a further step in the conservation program of the Canadian government with respect to the Winnipeg River powers, the first step of which has already been realized in the storage which has been arranged for in the Lake of the Woods by treaty with the United States and through the cooperation of Ontario. With the Lac Seul and Lake of the Woods storage in operation, the government estimates that the dependable flow on the Winnipeg River will be increased from 11,000 to 20,000 cu.ft. per second and the dependable horsepower increased from 400,000 to 750,000.

Fulton Iron Works Buys Foos Engine Company

The Fulton Iron Works of St. Louis, Mo., through its president, H. J. Steinbreder, has announced the purchase of the Foos Engine Company, of Springfield, Ohio, manufacturer of Diesel engines of 60 to 300 horsepower.

This purchase will give the company a complete line of Diesel engines ranging from 60 to 2,000 hp., as the St. Louis concern has been turning out the higher horsepower engines for some time. It will also add a line of gas engines to the Fulton products, which consisted principally of machinery for sugar refining prior to expansion into the engine field.

Coming Conventions

American Association of Engineers, annual convention, El Paso, Texas, June 4-6; M. E. McIver, secretary, 63 Adams St., Chicago.

American Boiler Manufacturers Association, annual convention, at Buckwood Inn, Shawnee-on-the-Delaware, Pa., June 11-13; A. C. Baker, secretary, 801 Rockefeller Bldg., Cleveland, Ohio.

American Institute of Electrical Engineers, annual Summer convention at Denver, Colo., June 25-29; F. L. Hutchinson, secretary, 33 West 39th St., New York City.

American Order of Steam Engineers, convention at Atlantic City, N. J., June 11-14, and exhibition with American Supplymen's Association. Address Fred L. Jahn, Watson of McDaniel Company, 146 N. Seventh St., Philadelphia.

American Society of Refrigerating Engineers, meeting at Detroit, June 4-7; W. H. Ross, secretary, 37 West 39th St., New York City.

American Society of Heating and Ventilating Engineers, Summer meeting at West Baden Springs Hotel, West Baden, Ind., June 26-29; A. V. Hutchinson, secretary, 29 West 39th St., New York City.

American Society of Mechanical Engineers, first national oil and gas power meeting at State College, Pa., June 14-16; Twin-City regional meeting at St. Paul, Aug. 27-30; Boston regional meeting, Oct. 1-3; second national fuels meeting at Cleveland, Ohio, Sept. 17-20; Calvin Rice, secretary, 29 West 39th St., New York City.

American Society for Testing Materials, Atlantic City, June 25-29.

American Water Works Association. Annual meeting, Hotel Fairmont, San Francisco, June 11-16; W. M. Niesley, 170 Broadway, New York City.

Association of Iron and Steel Electrical Engineers, annual convention and Iron and Steel Exposition at Hotel Stevens, Chicago, June 25-29.

Canadian Steel and Power Show at the University of Toronto Arena, Sept. 4-7; Campbell Bradshaw, secretary, 24 Front St., West Toronto, Canada.

National Association of Power Engineers, annual convention at Detroit, Sept. 11-15, and concurrently National Exhibitors' Assn. exhibit; Fred Raven, 417 South Dearborn St., Chicago. New England States Association convention at Hartford, Conn., June 21-23; K. W. Lundberg, secretary. Foot Guard Armory, Hartford.

National Board of Boiler and Pressure Vessel Inspectors, meeting at Erie, Pa., June 18-20.

National Electric Light Association, Convention and exhibition, Atlantic City, N. J., June 4-8; A. Jackson Marshall, secretary, 420 Lexington Ave., New York City.

National District Heating Association, annual meeting at Ambassador Hotel, Atlantic City, June 12-15; D. J. Gaskill, sec., 112 West 4th St., Greenville, Ohio.

National Association Practical Refrigerating Engineers, annual convention at Louisville, Kentucky, Nov. 20-23; E. H. Fox, secretary, 5707 West Lake St., Chicago, Ill.

Stoker Manufacturers Association, fall meeting at Greenbrier Hotel, White Sulphur Springs, W. Va., Oct. 22-24.

Universal Craftsmen Council of Engineers, Newark, N. J., Aug. 7-10.

Second Bituminous Coal Conference will be held at Pittsburgh, Nov. 19-22.

Pittsburgh Heating Station Construction Started

Excavation work has been completed, the foundations are being placed, and a second boiler has been authorized for the new Twelfth Street Steam Heating Station of the Allegheny County Steam Heating Company in Pittsburgh, a subsidiary of Duquesne Light Company, according to H. W. Fuller, vice-president in charge of engineering and construction, Byllesby Engineering and Management Corporation.

Steel now is being fabricated, and the first boiler is scheduled for operation Nov. 15, 1928, while the second boiler is scheduled to be in operation on Jan. 1, 1929.

Each of these boilers will have a capacity of 300,000 lb. of steam per hour with a peak capacity of 350,000 lb. per hour for short periods of time. A tunnel approximately 3,000 ft. in length will contain the mains which connect these boilers with the distribution system now served by the Stanwix Steam Heating Plant. The tunnel proper is scheduled to be 85 per cent completed by June 1.

Alabama Power Company Starts Construction of New Plant

Concrete work has been started by the Alabama Power Company, Birmingham, on its new steam plant on the Warrior River near Gorgas, Ala. Excavation is under way and is expected to be completed in the fall. This will include a canal to take water from the river to the plant for condensing purposes.

The installation of condensers will be started Oct. 1, it is said, while the boilers are expected to be erected in September and turbines installed in December. The plant will be brought into service around May 1, 1929. It will have a rated capacity of 80,000 hp., and will be the first of four units of similar capacity ultimately to be constructed, making the completed plant, according to newspaper reports, the largest electric generating station of its type in the South.

American Engineering Council Indorses Flood Commission

The creation of a commission of engineers as proposed in the Douglas Bill to investigate flood control and the development of the Colorado River was indorsed by the Administrative Board of the American Engineering Council at its recent meeting in Milwaukee.

Arthur W. Berresford, president of the Council, reported to the Board the Council's activity in the Mississippi flood legislation, and presented the report of the Committee on Boulder Dam, headed by Francis Lee Stuart, of New York, which unanimously decided against the engineering feasibility of the proposal outlined in the Swing-Johnson Bill.

American Association of Engineers Convene at El Paso, Texas

While the American Association of Engineers are holding their fourteenth annual convention in El Paso, Texas, June 5-6, the Centro National de Ingenerios meet at Juarez, Mexico, a near-by city, thus affording an opportunity for American and Mexican engineers to become acquainted.

Among the men scheduled to address the convention are H. M. Lull, executive vice-president, Southern Pacific Railroad; G. M. Butler, Dean, University of Arizona; Byron Cummings, Dean, University of Arizona; Brent Rickard, Manager, El Paso Smelting & Refining Company. In addition to these addresses various committee reports will be given throughout the three days of the convention.

On Tuesday, June 5, the annual barbecue will be held at the plant of the Southwestern Portland Cement Company, which, together with an inspection trip through the plant, promises an interesting afternoon.

For the entertainment of members attending the El Paso Convention four trips have been planned after the meeting. The trips planned are to Cloudcroft in the Sacramento Mountains, the Elephant Butte Dam on the Rio Grande River, Carlsbad Caverns in the Pecos Valley, and the Boquilla Dam near Santa Rosaria, Mexico.

During the convention additional entertainment is provided by a dinner dance in Juarez, Monday evening June 4, a smoker in the same city on the following evening and the annual banquet at the Hotel Hussmann on Wednesday, June 6.

Obituary

Sanford B. Belden, vice-president of the Jeffrey Manufacturing Company, died at the Hotel Chatham, New York City, May 15. Death is believed to have been caused by an embolus. The day previous to his death, Mr. Belden had gone to New York on a business trip. Shortly after his graduation in 1896 from the School of Mines of Ohio State University, Mr. Belden joined the Jeffrey organization. After serving some time in the sales department, he was made manager of the Jeffrey Pittsburgh office, which position he held for seventeen years. In 1909 he was promoted to the position of vice-president and manager of the mining division, and he continued in this position for seventeen years. In 1926 he took a much needed rest, returning after a year's vacation to a vice-presidency and directorship of the Jeffrey Manufacturing Company and, in addition, he was made chairman of the Board of Directors of the British Jeffrey-Diamond, Ltd., the Jeffrey British plant at Wakefield, England.

John Martin, chairman of the Board of the Mid-Continent Utilities Corporation, and former president of the Pacific Gas & Electric Company, died at San Francisco, May 23. He began his business career as a newsboy in Brooklyn, N. Y. In 1903 he became president of the North Shore Railway, now the Northwestern Pacific. Later he founded the Midway Gas Company and the Santa Cruz Beach Company. At the time of his death he was president of the South Eureka Mining Company, in Amador County, Calif.

Personals

Prof. William Jay Dana, M.E., of the Mechanical Engineering Department of North Carolina State College, will be connected during the coming summer with the Columbia Engineering & Management Corporation, Cincinnati, Ohio. He will be engaged in calculations for a new central steam heating station.

E. W. Nick, president of the Northern Equipment Company, Erie, Pa., has returned to America after an absence of several months in Europe. Mr. Nick visited the various European factories where Copes boiler feed water regulators are made. He also visited the Copes representatives in practically all of the countries of Western Europe.

E. D. Ratcliffe, formerly of the comptroller's office of the Puget Sound Power & Light Company, Seattle, Wash., is now connected with Stone & Webster, Boston, Mass.

O. J. Miller, for the last five years superintendent of production for the Tennessee Electric Power Company, has been appointed manager of the production and transmission departments of the company.

A. J. Foley, formerly in the engineering department of the Widdell Engineering Company, is now associated with the Graver Corporation, Pittsburgh, Pa.

Dr. Herbert C. Sodler, head of the Department of Naval Architecture and Marine Engineering, has been appointed Dean of the Colleges of Engineering and Architecture at the University of Michigan.

Business Notes

The C. O. Bartlett & Snow Company, of Cleveland, Ohio, announces the appointment of J. R. Allison, formerly with the Carnegie Steel Company, to their Pittsburgh office at 406 Bessemer Building. Mr. Allison has a wide experience in both maintenance and construction in steel mills and railroads.

Baker & Spencer, consulting engineers, announce the removal of their New York office on June 1 from 117 Liberty St., to 17 Battery Place.

F. C. Allen, Jr., the founder and former president of Allen & Billmyre Company, Inc., has recently severed his connection with that organization. He is now president of the Allen Air Appliance Company, Inc., Grand Central Terminal Building, New York City. The products of Allen Air Appliance Company, Inc., are sold under the trade mark "AAA" and include a complete line of centrifugal blowers and exhausters in the single- and multi-stage types and a complete line of stationary and heavy-duty portable vacuum cleaners.

The Armstrong Manufacturing Company has announced that on May 1 the management of the company was taken over by another branch of the Armstrong family. B. I. Ashmun, who has been continuously associated with the business since 1893, is the vice-president, and his son Frederick S. Ashmun, is secretary and treasurer. L. H. Taylor has been placed in charge of sales for the Middle West with offices at 9 S. Clinton St., Chicago. The New York office has been moved from 181 Lafayette St. to 27 Cleveland Place.

Fuel Prices

COAL

The following table shows the trend of the spot steam market in various coals, f.o.b. mines; mine run, except Pittsburgh gas slack:

Bituminous (Net Tons)	Market Quoting	Price per Ton
Navy Standard	New York	$2.35@$2.60
Kanawha	Columbus	1.25@ 1.60
Smokeless	Cincinnati	1.75@ 2.00
Smokeless	Chicago	1.65@ 2.00
S. E. Kentucky	Chicago	1.35@ 1.75
Steam	Pittsburgh	1.40@ 1.80
Gas Slack	Pittsburgh	1.15@ 1.25
Big Seam	Birmingham	1.40@ 1.75
Anthracite (Gross Tons)		
Buckwheat	New York	$2.75@$3.00
Birdseye	New York	1.60

FUEL OIL

New York—May 31, industrial use, tank-car lots, 28@34 deg., Baumé, 5c. per gal.; 36@40 deg., furnace, 7c. per gal., f.o.b. Bayonne, N. J.

St. Louis — May 22, tank-car lots, f.o.b. St. Louis, 24@26 deg., $1.50 per bbl.; 26@28 deg., $1.55 per bbl.; 28@30 deg., $1.60 per bbl.; 30@32 deg., $1.65 per bbl.; 32@36 deg., gas oil, 4.4c. per gal.; 38@40 deg., 4.98c. per gal.

Pittsburgh—May 21, f.o.b. local refinery, 30@34 deg., fuel oil, 5¼c. per gal.; 36@40 deg., 5½c. per gal.

Philadelphia—May 26, 26@30 deg., $2.07 per bbl.; 13@19 deg., $1.22 per bbl.; 22 plus, $1.48@$1.55 per bbl.; 27@30 deg., $2.17 per bbl.

Cincinnati—May 22, tank-car lots, f.o.b. local refinery, 24@26 deg. Baumé, 5c. per gal.; 26@30 deg., 5½c. per gal.; 30@32 deg., 5.95c. per gal.

Chicago—May 25, tank-car lots, f.o.b. Oklahoma, freight to Chicago, 90c. per bbl.; 22@26 deg., 80c. per bbl.; 26@30 deg., 85c. per bbl.; 30@32 deg., $1.02½@$1.05 per bbl.

Boston—May 28, tank-car lots, f.o.b. 12@14 deg. Baumé, 4.45c. per gal.; 28@32 deg., 5.65c. per gal.

Dallas—May 26, f.o.b. local refinery, 26@30 deg., $1.40 per bbl.

TRADE CATALOGS

UNIT PULVERIZER—The operating characteristics of the Riley Atrita unit pulverizer are clearly presented and the features of construction are unusually well illustrated in a 28-page bulletin just issued by the Riley Stoker Corporation, Worcester, Mass. Each part of the pulverizer and the flare-type burner, which is especially adapted to horizontal firing, are described in detail. Several illustrations of typical installations as applied to the various types of boilers are included.

CHARTS, FORMULÆ AND RULES—The Crescent Refractories Company, Curwensville, Pa., has just issued a little loose-leaf booklet containing technical bulletin Nos. 1 to 20. The booklet is entitled "Charts, Formulæ and Simple Rules," and has been compiled for use of persons interested in refractory linings.

MAGNETIC CLUTCHES—The Magnetic Manufacturing Company, of Milwaukee, Wis., has just issued bulletin No. 72, which contains interesting data and information covering the application of high-duty magnetic clutches.

AUTOMATIC TIME SWITCHES—R. W. Cramer & Company, Inc., 136 Liberty Street, New York, have recently issued catalog No. 2, descriptive of all types of Sauter Time Switches and showing some of the many uses to which time switches may be placed.

DEAËRATORS—In bulletin No. 8 the Elliott Company, Jeannette, Pa., briefly reviews the corrosion problem on power plants and the process of deaërating water for the removal of dissolved oxygen and other gases. The bulletin describes in detail the Elliott vacuum, atmospheric and pressure types of power-plant deaërators.

STEAM TRAP—H. O. Trerice Company, 1338 W. Lafayette Blvd., Detroit, Mich., has recently issued Catalog No. 1, illustrating and describing the Trerice steam trap, which is being made in capacities from 2,500 to 15,000 lb. of condensate per hour, and in sizes from ½-in. to 2-in. The trap is unusually simple and has few moving parts.

TURBINE BLOWERS—L. J. Wing Manufacturing Company, 154 West 14th St., New York, has just published a well-illustrated booklet, No. 700 on its turbine blowers. The results obtained by the use of Wing forced-draft blowers in both hand-fired and stokered plants is outlined.

COMBUSTION CONTROLLERS — The Hagan Corporation, 304 Ross St., Pittsburgh, Pa., has just published Bulletin No. 102, describing its balanced-float controllers, which are an essential part of the Hagan System of Compensated draft. The booklet is well illustrated with large sectional line drawings and halftones, and the method of operation is clearly presented.

REVOLUTION COUNTERS—The Bristol COMPANY, Waterbury, Conn., has just published a six-page bulletin describing its various types of counters, including the barrel, lock-bar, engine and magnetic types, the last-named being made for alternating or direct current and suitable for placing a considerable distance from the point of counting.

STEAM TRAP—The Nicholson weight-operated trap for use on steam, air or gas, is described in bulletin No. 528 recently issued by W. H. Nicholson & Co., Wilkes-Barre, Pa. In this trap the discharge valve opens and closes with a rapid motion, eliminating wiredrawing. The trap is made for eleven ranges of pressure varying from 0 to 10 lb. to 0 to 450 pounds.

UNIT HEATERS—The Bayley Blower Company, 732-750 Greenbush St., Milwaukee, Wis., has just published a four-page bulletin entitled "Cold Facts on a Hot Subject," describing its "Chinook-fin" unit heater. In this heater the radiating tubes have extended surfaces, and each is free to expand or contract independently of other tubes in the unit.

NEW PLANT CONSTRUCTION

Compiled by the McGraw-Hill Business News Department, which is prepared to furnish a more complete daily service to those who wish it

Ark., Pine Bluff — City is having preliminary plans prepared for the construction of a pumping station in connection with drain, flood gates, etc. Estimated cost $216,000. William Crooks Engineering Co., Home Insurance Bldg., Little Rock, is engineer.

Calif., Berkeley—Bd. of Regents, University of California, is having plans prepared for a 5 story infirmary building on College Ave. Estimated cost $1,750,000. A. Brown, Jr., 251 Kearny St., San Francisco, is architect.

Calif., Coronado—R. M. Bates, Jr., 660 South Vermont St., Los Angeles, Archt., will soon award contract for the construction of an 8 story hotel including steam heating and refrigeration systems, elevators, etc, here. Estimated cost $1,000,000.

Calif., Los Angeles—City will soon award contract for the construction of sewage treatment works including pumping system, etc., at Section 1, Venice Outfall.

Calif., Los Angeles—Hollywood Business Properties, Inc., 908 Guaranty Bldg., plans the construction of a 13 story building at Vine St. and Hollywood Blvd. Estimated cost $700,000. K. MacDonald, Jr., Spring Arcade Bldg., is architect.

Calif., Los Angeles — Kingsley Manor Corp., c/o C. J. Dwyer Co., 3142 Wilshire Blvd., Archt., is having plans prepared for an 11 story apartment building on South Kingsley Dr. Estimated cost $1,000,000.

Calif., Los Angeles — Lincoln Mortgage Co., 523 South Spring St., is having plans prepared for a 12 story apartment building including elevators, etc. at Flower and 6th Sts. Estimated cost $1,250,000. Allison & Allison, 1005 Hibernian Bldg., are architects.

Calif., Los Angeles—Los Angeles County, will receive bids until July 2, for the construction of an 11 story county hospital including steam heating, ventilation and refrigeration systems, etc. Estimated cost $5,000,000.

Calif., Los Angeles — E. R. Smith, Guaranty Bldg., Hollywood, is having plans prepared for a 10 story bank and office building on Hollywood Blvd., here. Estimated cost $1,000,000. Curlett & Beelman, Union Bank Bldg., Los Angeles, are architects.

Conn., New Haven—United Illuminating Co., 84 Temple St., awarded contract for superstructure of a power plant to Foundation Co., 120 Liberty St., New York, N. Y. Estimated cost $3,000,000.

Ga., Atlanta — Rhodes Haverty Investment Co. is having plans prepared for a 17 story office building at James and Forsythe Sts. Estimated cost $600,000. Pringle & Smith, Norris Bldg., are architects.

Ga., Newton—Baker County Power Co., operating under the management of W. B. Foshay Co., 826 Second Ave., Minneapolis, Minn., awarded contract for the construction of first unit of a 675 hp. Diesel plant here as an auxiliary to hydro-electric plant, to McIntosh & Seymour Corp., Auburn, N. Y. Ultimate total capacity of plant 2,000 to 3,000 hp.

Ill., Chicago—W. C. Bannerman & Co., 77 West Washington St., are having sketches made for a 13 story apartment building at 78th St. and Rainbow Park. Estimated cost $1,000,000. R. S. DeCoyler & Co., 307 North Michigan Ave., are architects.

Ill., Chicago — J. Bauer, c/o Sidney Michin, Inc., 139 North Clark St., Archt., is having plans prepared for a 5 story apartment building on Oakdale Ave. Estimated cost $675,000.

Ill., Chicago—M. L. Bein & Co., 64 West Randolph St., Archts., are receiving bids for a 12 story apartment building on Commonwealth Ave. for Syndicate, c/o architect.

Ill., Chicago—H. W. Rubloff, 10 South La Salle St., had plans prepared for a 19 story office building, etc. at Wabash Ave. and Harrison St. Estimated cost $3,500,000. A. S. Alschuler, 28 East Jackson Blvd., is architect.

Ill., Chicago — Washington Plaza Building Corp., c/o Leichenko & Esser, 38 South Dearborn St., Archts., is having plans prepared for a 7 story, hotel at 5609-5615 Washington Blvd. Estimated cost $700,000.

Ind., Fort Wayne—N. Goldman, awarded contract for a 6 story department store at Wayne and Calhoun Sts. to W. A. Sheets, 334 Utility Bldg. Estimated cost $1,000,000.

Ia., Dubuque—Rosenthal Theatre Corp., N. Rosenthal, Secy., will soon receive bids for a hotel, theatre and stores building including steam heating system, etc. at Main and Iowa Sts. Estimated cost $850,000. W. P. Whitney, 6951 South Green St., Chicago, Ill., is architect.

La., Alexandria—U. S. Veterans' Bureau, Room 764, Arlington Bldg., Washington, D. C., will receive bids until July 5, for the construction of buildings and utilities including ice-making and refrigeration plant, here.

La., New Orleans—B. G. Carbajal, Inc., Marbec Hotel, plans the construction of a 25 story hotel including steam heating and refrigeration systems, boilers, pumps, elevators, etc. on Canal St. Estimated cost $1,500,000. E. Weil, Whitney Bank Bldg., is architect.

Mass., Ayer—Nashoba Cold Storage Co., H. Gilmore, Pres., c/o Haynes & Mason, 280 Main St., Fitchburg, Archts., is receiving bids for a 70 x 165 ft. cold storage and packing plant, here. Estimated cost $50,000.

Mass., Boston—Tenney Building Trust, c/o Coffin & Taber, 24 Milk St., awarded contract for a 14 story office building at Devonshire, Franklin and Federal Sts. to

G. W. Harvy Co., 100 Milk St. Estimated cost $1,000,000.

Mass., Hyde Park (Boston P. O.)—Edison Electric Illuminating Co., 39 Boylston St., Boston, awarded contract for addition to power sub-station on Fairmount Ave. here to Engineering Construction Co., 8 Beacon St., Boston. Estimated cost $40,000.

Mass., Jamaica Plain (Boston P. O.)—Faulkner Hospital, 1153 Central St., Roxbury, awarded contract for a 4 story surgical building and power house here to C. S. Henry Co., 82 Devonshire St., Boston.

Mass., Roxbury (Boston P. O.) — Children's Hospital, G. Myer, Chn. Bldg. Comn., 53 State St., Boston, is having tentative sketches made for addition to hospital on Longwood Ave., here. Estimated cost $1,000,000. Coolidge, Shepley, Bulfinch & Abbott, Ames Bldg., Boston, are architects.

Mich., Detroit—Treasury Dept., Washington, D. C., will soon award contract for the construction of a hospital including steam heating and ventilation systems, boilers, elevators, etc. here. Estimated cost $600,000. J. A. Wetmore, Washington, D. C., is supervising architect.

Mo., Koch—Bd. of Public Service, St. Louis, is having preliminary plans prepared for addition to Robert Koch Tuberculosis Sanitorium. here. Estimated cost $2,000,000.

Mo., St. Louis — Continental Life Insurance Co., E. Mays, Pres., 10th and Olive Sts., will soon receive bids for a 20 story bank and office building at Olive St. and Grand Blvd. Estimated cost $1,500,000. W. B. Ittner, 911 Locust St., is architect.

Mo., St. Louis — R. A. Walker, 3545 Lindell Blvd., is having preliminary plans prepared for a 16 story hotel including steam heating system, etc. at Lindell and Grand Blvds. Estimated cost $1,000,000.

N. J., Metuchen—Public Service Electric & Gas Co., 80 Park Pl., Newark, will build a transformer station, 132,000 v. capacity, here. Estimated cost $40,000. Public Service Production Co., 80 Park Pl., Newark, is engineer.

N. J., Newark — Majestic Holding Co., c/o W. E. Lehman, 972 Broad St., Archt., is having plans prepared for a 15 story hotel including steam heating, ventilation and refrigeration systems, boilers, elevators, etc. at Broad and Hill Sts. Estimated cost $2,000,000.

N. J., Roseland—Public Service Electric & Gas Co., 80 Park Pl., Newark, will build a transformer station 132,000 v. capacity, here. Estimated cost $40,000. Public Service Production Co., 80 Park Pl., Newark, Engr. Work will be done by separate contracts.

N. Y., Buffalo—Marine Trust Co., Seneca and Main Sts., awarded contract for a 20 story bank and office building at Washington St. and Broadway to John W. Cowper Co., Fidelity Bldg. Estimated cost $2,500,000.

N. Y., New York—United States Realty & Improvement Co., 111 Broadway, is having plans prepared for a 34 story office building at Madison Ave. and 57th St. to G. A. Fuller Co., 949 Broadway. Estimated cost $3,000,000.

N. Y., St. George—St. George Gardens, Inc., 26 Court St., Brooklyn, plans the construction of four 6 story apartment buildings at St. Marks Pl. and Westerwelt Ave. Estimated cost $1,200,000. S. Gardstein, 44 Court St., Brooklyn, is architect.

N. Y., Syracuse — Hub Realty Corp., awarded contract for a 12 story office building on South Saline St. to James Hefferman, 721 South Saline St. Estimated cost $1,200,000.

N. Y., Yonkers — Tudor Hall, Inc., 1 Bright Pl., awarded contract for an apartment building on Alta Ave. to Lordi Construction Co., 36 East 208th St., New York. Estimated cost $2,000,000.

Okla., Cushing—City is having preliminary plans prepared for the construction of a 1,000 hp. Diesel engine municipal power plant including equipment. Estimated cost $100,000. Long & Co., Colcord Bldg., Oklahoma City, are engineers.

Pa., Philadelphia — W. Goldstein, Stock Exchange Bldg., plans the construction of a 21 story office building at 20th and Market Sts. L. B. Rothschild, 215 South Broad St., is architect.

Tex., Brownsville — J. A. Taylor, 2332 Indiana St., Houston, Engr., will soon receive bids for the construction of a cold storage plant here, for Roy Sethman & Associates, Brownsville. Estimated cost $250,000.

Tex., San Antonio—J. X. Newcombe, c/o Blue Bonnet Hotel, is having plans prepared for the construction of 40 ton ice plant at Hackberry and High Sts.

Tex., San Antonio—San Antonio Athletic Club, 217 Nacogdoches St., is having plans prepared for a 12 story club and office building at Houston and Nacogdoches Sts. Estimated cost $1,000,000. L. Harrington, & Co., Builders Exchange Bldg., are achitects and engineers.

Tex., San Antonio—Swiss Plaza Building Co., c/o F. L. Hillyer, Pres., 1309 South Flores St., plans the construction of a 22 story Swiss Plaza hotel including steam heating, ventilation and refrigeration systems, boilers, pumps, swimming pool, etc. at McCullough Ave. and Olmos Dr. Estimated cost $1,200,000. Phelps & DeWees, 618 Gunter Bldg., are architects.

Wash., Seattle—V. W. Voorhees, Lloyd Bldg., Archt., will receive bids until Sept. 15 for a 14 story hotel at Third and Union Sts. for J. A. Vance, Lloyd Bldg. Estimated cost $1,000,000.

Wis., Milwaukee—Hillcrest Hotel Co., c/o C. J. Keller & Son, 522 Van Buren St., Archts., will soon award contract for an 8 story hotel including steam heating and refrigeration systems, elevators, etc. on Wisconsin Ave. Estimated cost $500,000.

B. C., Upper Bennington Falls — City awarded contract for the construction of third unit of hydro-electric light and power plant, 3,000 hp., including installation of new wheel, generator, etc., to Stuart Cameron Co., Ltd., Vancouver. Estimated cost $240,000.

Que., Levis — Etchemin Hydro-Electric Co., Ltd., plans the construction of a dam and transmission line to supply power in Levis and Dorchester counties. Estimated cost $300,000.

Que., Three Rivers—Dominion Coal Co., Ltd., Glace Bay, N. S., awarded contract for the construction of a cold storage plant on Notre Dame St. here to Foundation Co., 76 Sherbrooke St., Montreal, Que. Estimated cost $400,000.

Equipment Wanted

Air Compressor — Engineer Office, War Dept., Washington, D. C., will receive bids until June 6 for an electrically driven air compressor complete at New Orleans, La.

Air Compressors, Etc.—State Bd. of Control, Austin, Tex., will receive bids until June 21, for five portable air compressors, complete with 1 ton trucks, etc.

Generator and Water Softener — Iowa Public Service Co., D. Sterns, Pres., Ft. Dodge, Ia., plans the installation of a 1,500 kw. steam generator and water softener for proposed improvements to power plant at Charles City, Ia. Estimated cost $75,000.

Pump, Motor, Etc.—T. C. Petrie, Clk., Garland, Neb., will receive bids until June 14, for a 60 g.p.m. single stroke pump, one 15 hp. 3 ph., 60 cycle, 220 v., 1,200 r.p.m. auto start motor, etc. for proposed waterworks system. Estimated cost $21,250.

Pumping Equipment—City of Waukesha, Wis., will receive bids until June 11, for pumping equipment, etc. for proposed sewage disposal plant.

Pumping Equipment — Bd. of Water Comrs., New Britain, Conn., will receive bids until June 21, for pumping equipment, etc. for proposed waterworks improvements. Estimated total cost $1,000,000.

Pumping Equipment—City of Holdenville, Okla., plans to purchase pumping equipment, etc. for proposed waterworks system. Estimated cost $178,000.

Pumping Unit—Bd. of Awards, Baltimore, Md., will receive bids until June 6 for a 30 m.g.p.d. pumping unit for Eastern Ave. Sewage pumping station, Eastern Ave. and President St.

Pumps, Etc. — W. S. Mayre, Mayor, Mangham, La., will receive bids until June 7, for pumps, etc. for proposed waterworks improvements. Estimated cost $15,000.

Pumps, Etc.—Town of Picton, Ont., plans to purchase electrical centrifugal pumps, etc. for proposed waterworks improvements. Estimated cost $50,000.

Pumps and Motors—City of Pipestone, Minn., will receive bids until June 11, for furnishing and installing three horizontal centrifugal pumps with motors and one vertical turbine pump with motor.

Refrigerating and Ice Making Unit—U. S. Engineer Office, War Dept., Washington, D. C., will receive bids until June 7 for a refrigerating and ice making unit for U. S. Steamer "General John Newton," at New Orleans, La.

Industrial Projects

Ill., East St. Louis—FOUNDRY ADDITION—Southern Malleable Iron Co., 21st St. and Bond Ave., awarded contract for a 1 story, 85 x 279 ft. addition to iron foundry to St. Louis Structural Steel Co., Syndicate Trust Bldg. Estimated cost $40,000.

Ia., Waterloo—TRACTOR FACTORY—John Deere Tractor Co. is having plans prepared for a 6 story factory. Estimated cost $150,000.

Mass., Cambridge (Boston P. O.)—BRASS FOUNDRY — Barbour-Stockwell Co., 205 Broadway, awarded contract for the construction of a brass foundry at Broadway and Market St. to W. Fillmore Co., Cherry St.

Miss., Laurel—LUMBER PLANT—Eastman-Gardiner Co., plans to rebuild plant recently destroyed by fire. Estimated cost $1,000.000.

N. J., Camden — INK RIBBON FACTORY—Direct Ink Ribbon Corp., 32 North 5th St., awarded contract for a 2 story, 50 x 175 ft. factory at 20th and Federal Sts., to Graham Chambley Co., 3649 Tilbert St., Philadelphia, Pa. Estimated cost $60,000.

N. J., Paulsboro — CAN FACTORY — Vacuum Oil Co., awarded contract for a 2 story, 122 x 222 ft. factory to White Construction Co., Jefferson Bldg., Philadelphia.

N. C., High Point—HOSIERY MILL—Hatch Full Fashioned Hosiery Co., has acquired 21 acres of land and plans the construction of a plant. Estimated cost $200,000. J. M. Hatch, 504 Elizabeth Ave., Charlotte and A. C. Lineberger, Belmont, are interested.

O., Barberton — RUBBER FACTORY — Seiberling Rubber Co., will soon award contract for the construction of a 2 story factory on West Barberton St. Estimated cost $110,000.

O., Lima — FOUNDRY — Ohio Steel Foundry Co., J. E. Galvin, Pres., manufacturers of locomotive castings, awarded contract for a 1 story, 53 x 253 ft. foundry to H. K. Ferguson Co., Hanna Bldg., Cleveland. Estimated cost $75,000.

O., Springfield — CASKET FACTORY — Springfield Metallic Casket Co. plans the construction of a 5 story addition to factory. Estimated cost $100,000.

O., Toledo—GLASS FACTORY—Libby Owens Sheet Glass Co., Nicholas Bldg., plans the construction of a factory. Estimated cost $1,000,000. Lockwood, Greene & Co., Hanna Bldg., Cleveland, are architects.

O., Zanesville—TILE FACTORY—American Encaustic Tile Co. awarded contract for a 1 story, 100 x 150 ft. factory to The Austin Co., Union Trust Bldg. Estimated cost $400,000.

Oklahoma-Texas-Louisiana—GAS PLANT ADDITIONS — Southwest Gas Utilities Corp., Ada, Okla., voted $1,000,000 bonds for plant improvements in Oklahoma, Texas and Louisiana. Private plans.

Pa., Langeloth—ZINC and CHEMICAL PLANT—American Zinc & Chemical Co., Clark Bldg., Pittsburgh, awarded contract for a 1 and 2 story addition to plant here to Rust Engineering Co., American State Bank Bldg., Pittsburgh. Estimated cost $400,000.

Man., Winnipeg—EXPLOSIVE PLANT—Canadian Industries, Ltd., A. B. Purvis, Pres., Canada Cement Bldg., Montreal, Que., plans the construction of a plant, here. Estimated cost $1,000,000.

N. B., Chaleur Bay—PULP and PAPER MILL—International Paper Co., 100 East 42nd St., New York, N. Y., plans the construction of a pulp and paper mill, 250 ton daily capacity here. Estimated cost approximately $6,500,000. Private plans. Power to be supplied by subsidiary, St. John River Power Co. Also plans a mill in Ontario, 200 to 300 ton capacity, $6,000,000.

Ont., Saute Ste Marie — BENZOL PLANT — Lake Superior Corp., 503 Queen St. E., is having plans prepared for the construction of a benzol plant. Estimated cost $200,000.

Mexico Nuevo Laredo — REFINERY — Cautemoc Refining Co., c/o R. Laurel, Laredo, Tex., will build a gasoline and lubricating refinery 1500 bbl. capacity here. Estimated cost $100,000. Private plans.